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Bryophytes of the cloud forest of Pico do Marumbi State Park, Paraná, Brazil

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Abstract

Bryophyte diversity in tropical forests is closely related to elevation. A survey was undertaken of the bryoflora of a poorly known cloud forest environment from 1,000 to 1,500 m.a.s. in Pico do Marumbi State Park, state of Paraná, Brazil. The aim was to analyze the geographical range of the bryoflora and significance of this elevational zone to bryophyte diversity. We found 364 bryophyte species, including 187 species of mosses, 175 liverworts and two hornworts. This diversity represents 40% of the bryoflora of Paraná and 24% of that of Brazil. Forty-one Brazilian endemic species were found, representing a highly relevant feature for the preservation of the area. These results emphasize the importance of Pico do Marumbi State Park to the conservation of bryophyte diversity and to understanding the species of the state of Paraná, as well as demonstrating the importance of bryophyte surveys in the Atlantic Forest of Southeast Brazil.

Keywords

Mosses; liverworts; Neotropics; cloud forest.

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Introduction

Bryophytes are avascular terrestrial plants whose sexual reproduction is dependent on water because of their flagellated anterozoids. In their lifecycle, the gametophytic generation (haploid) is predominant over their sporophytic generation (diploid) (Gradstein et al. 2001). They are the second largest group of terrestrial plants (Frahm 2003), and currently, they comprise 3 divisions, the Anthocerothophyta (hornworts), the Marchantiophyta (liverworts), and the Bryophyta (mosses) (Shaw and Goffinet 2009).

There are 1548 species of bryophytes reported from Brazil, with 541 species occurring in the state of Paraná (Yano 2013, 2014, Ristow et al. 2015), 570 species in the state of Rio Grande do Sul, and 542 in the state of Santa Catarina (Costa and Peralta 2017).

The first studies of bryophytes of Paraná were those of Angely (1961, 1965, 1968), who produced a list of taxa. Kummrow and Prevedello (1982) published a list of samples deposited in the herbarium MBM (Municipal Botanical Museum, Curitiba). Hirai et al. (1998) undertook a floristic survey in a small secondary *Araucaria* forest, and Yano and Colletes (2000) investigated the

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bryophytes of an area of Atlantic Forest. Recently Yano (2013, 2014) published a compilation of the literature on bryophyte taxa of t Paraná and listed 706 taxa. Since then, Ristow et al. (2015) added 203 species records for the state.

Studies of bryophytes in Brazilian cloud forests remain scarce and are non-existent for the state of Paraná. The studies of Santos and Costa (2010) and Costa et al. (2015) represent the only bryophyte investigations conducted above 1000 m above sea level in Brazil. These authors indicated that bryophtes were the richest and most diverse above this elevation. The results of several other authors are consistent with this finding (Enroth 1990, Frahm 1990, Gradstein 1991, Kessler 2000, Santos and Costa 2010, Costa et al 2015).

Pico do Marumbi State Park (PMSP) is located in southern Brazil, and is 1 of the 10 centers of diversity and endemism in tropical America (Tan and Pócs 2000), and thus, it offers an excellent environment for the study of bryophyte diversity. PMSP is completely within the Atlantic Forest biome and comprises Dense High Mountain Ombrophylous Forest phytophysiognomy. These unique high-elevation montane forests possess high endemism and, in general, are subjected to minimal anthropogenic disturbance due their difficult access (Scheer et al. 2011).

The forest vegetation of PMSP decreases in size with increasing elevation and because soil is replaced by rocky outcrops near 1400–1500 m elevation. At elevations of 1000–1400 m the vegetation in the park is cloud (IBGE 2012). forest. The term "cloud forest" derives of the high condensation of evaporated water in the air, which forms a haze and maintains high precipitation. The features of cloud forest correspond to an arboreal mesophanerophytic formation (reaching >30 m), which is typically located on the summits of higher mountains (1000–1500 m elevation) (Roderjan et al. 2002, Scheer et al. 2011).

Upper Montane Forests and High-Altitude Meadows are fundamental to the conservation of bryophyte diversity in the Atlantic Forest, and Santos and Costa (2010) and Costa et al. (2015) emphasized the importance of their protection and conservation. The objective of our study is to record and analyze the floristic composition of bryophytes occurring in the cloud forest of Pico do Marumbi State Park, as well as to evaluate the geographic distributions of bryophyte species found.

Methods

Study area. PMSP (Fig. 1) is located between the cities of Morretes, Quatro Barras, and Piraquara, and covers an area of 8745 ha (IAP 2012). It is within the Atlantic Forest domain (IAP 1996) and includes areas of Dense Ombrophylous Submountain Forest, Dense Mountain Ombrophylous Forest, and Dense High Mountain Ombrophylous Forest in good states of preservation. The floristic composition and tree layer structure varies along the elevational gradient (Figs 2–7).

Floristic surveys. Sampling was permitted by the Instituto Ambiental do Paraná (IAP), and we followed the methodology of Frahm (2003). Random collects were performed using pre-existent trails (approximate coordinates plotted in Fig. 1) with an effort made to cover the range of habitats and microhabitats available in cloud forests between 1000 and 1400 m above sea level. Eleven expeditions were taken from March 2014 to June 2015. The samples were deposited in the Maria Eneyda P. K. Fidalgo (SP) herbarium with duplicates in Departamento de Botânica da Universidade Federal do Paraná (UPCB) herbarium.

Bryophyte identification. Bryophytes were identified from the preparation of slides and their observation with stereo- and optical microscopes using specialized literature according to each family (Frahm 1991, Sharp et al. 1994, Yano and Carvalho 1995, Buck 1998, Gradstein et al. 2001, Gradstein and Costa 2003, Yano and Peralta 2009, Yano and Peralta 2011) and comparisons with herbarium specimens.

The classification systems follow Söderström et al. (2016) for Anthocerotophyta and Marchantiophyta and Goffinet et al. (2009) for Bryophyta. Author abbreviations for the specific epithets followed Brummitt and Powell (1992). The species list provided here is in alphabetical order by division, family and species. The geographic distributions in Brazil follow the standardization of Valente and Porto (2006), who classify species as Endemic, Rare, Moderate or Wide, while the occurrences in states followed Costa and Peralta (2015) and Gradstein and Costa (2003).

Results

We found 364 bryophyte species, including 187 species of mosses (35 families, 85 genera), 175 liverworts (22 families, 58 genera) and two hornworts (1 family, 2 genera). The richest families of Marchantiophyta were Lejeuneaceae with 66 species (18%) and Lepidoziaceae with 16 species (4%). For Bryophyta, the most speciose families were Leucobryaceae with 19 species (5%), Pilotrichaceae with 16 species, Sematophyllaceae with 15 species, Dicranaceae with 14 species, Fissidentaceae and Sphagnaceae with 13 species each, Orthotrichaceae with 10 species and Bryaceae with nine species (Table 1).

Here we provide, in alphabetical order, brief characterizations of the 41 Brazilian endemic species found in PMSP. This list follows the characterization of cloud forest by Costa et al. (2015), with species tolerant to wide environmental variation, such as low temperatures, high humidity, and high light intensity.

***Aptychopsis pyrrhophylla* (Müll. Hal.) Wijk & Margad.**

Comments: distinguished by ovate leaves with cuspidate apexes. Habitat: corticicolous. Geographic distribution: Amazonian and Atlantic Forest at various elevations but more common above 1500 m. Brazilian geographic distribution: AM, BA, ES, MG, RJ, SP.

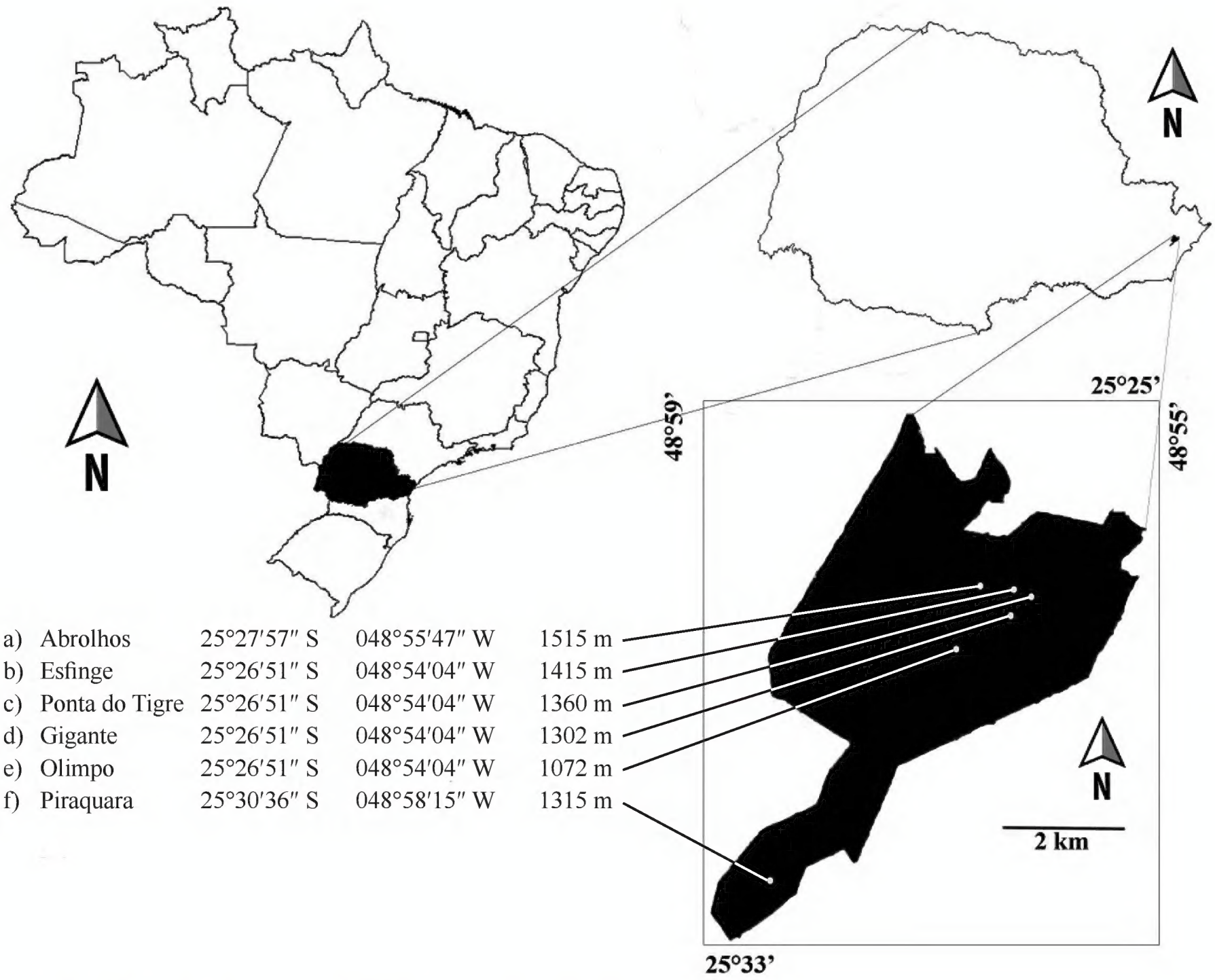


Figure 1. Location map of Pico do Marumbi State Park in Paraná state.

***Atractylocarpus brasiliensis* (Müll. Hal.) R.S. Williams**

Comments: differs from *Atractylocarpus nanus* R.S Williams, an Andean species, by having a less rugose dorsal surface of costa; shorter exotechial cells; and peristome teeth divided from the base. Habitat: soil. Geographic distribution: Atlantic Forest (high montane). Brazilian geographic distribution: BA, RJ.

***Barbula riograndensis* E.B. Bartram**

Comments: distinguishable from any other known Brazilian species of *Barbula* by costa with dorsal and ventral bands of stereids in cross section, and short, yellow and strongly dentate apiculi. Habitat: soil, rocks and streams. Geographic distribution: Atlantic Forest (lowlands). Brazilian geographic distribution: PR, RS.

***Bazzania heterostipa* (Steph.) Fulford**

Comments: forked, terminal branching scarce and plants without terminal branches may be mistaken with species of *Calypogeia*; the presence of a vitta in the leaves immediately separates this species from *Calypogeia*. Habitat: soil, rocks and corticicolous. Geographic distribution: Atlantic Forest. Brazilian geographic distribution: BA, ES, MG, PE, PR, RJ, RS, SC, SP.

***Brachythecium poadelphus* Müll. Hal.** (Figure 10)

Comments: recognized by its medium to large size; leaves approximately 2.0 × 0.8 mm; distinctly different weak alar cells; dioicous. Habitat: corticicolous. Geographic distribution: Atlantic Forest (montane). Brazilian geographic distribution: MG, RJ, SP.

***Campylopus dichrostis* (Mull. Hal.) Paris**

Comments: characterized by leaf lamina reaching the apex; percurrent costa with lamellae; dorsal and ventral stereids in transverse section. Habitat: soil and rocks. Geographic distribution: Atlantic Forest and Cerrado. Brazilian geographic distribution: BA, GO, MG, RJ, RS, SC, SP.

***Campylopus fragilis* (Brid.) Bruch & Schimp.**

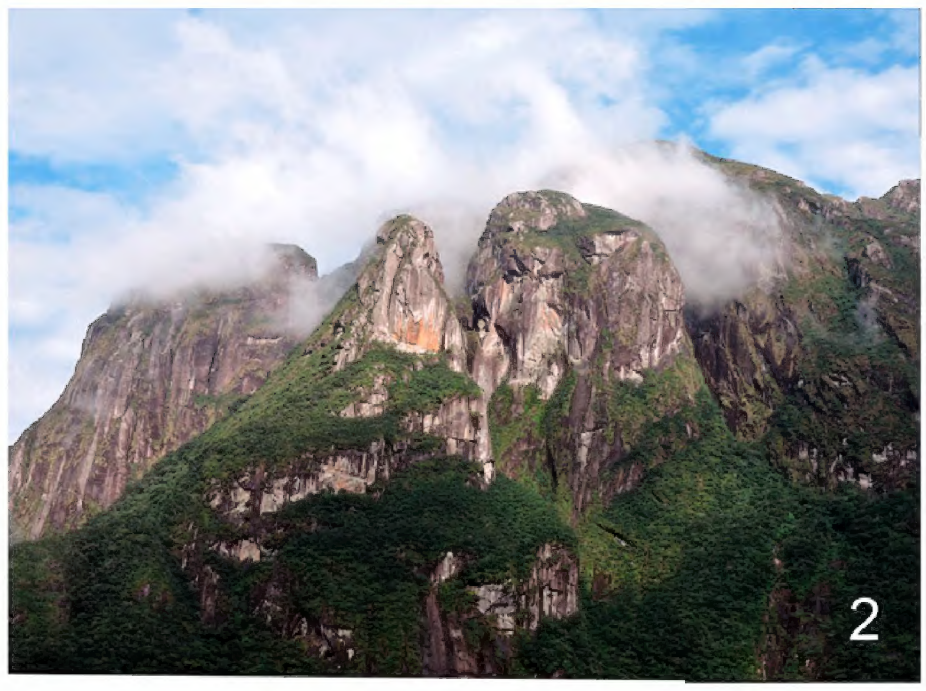
Comments: characterized by masses of sessile brood leaves; hyaline basal leaf cells grading evenly into the quadrate median leaf cells; alar cells absent. Habitat: soil, decomposing tree trunks and rocks. Geographic distribution: Atlantic Forest. Brazilian geographic distribution: MG, RJ, SC, SP.

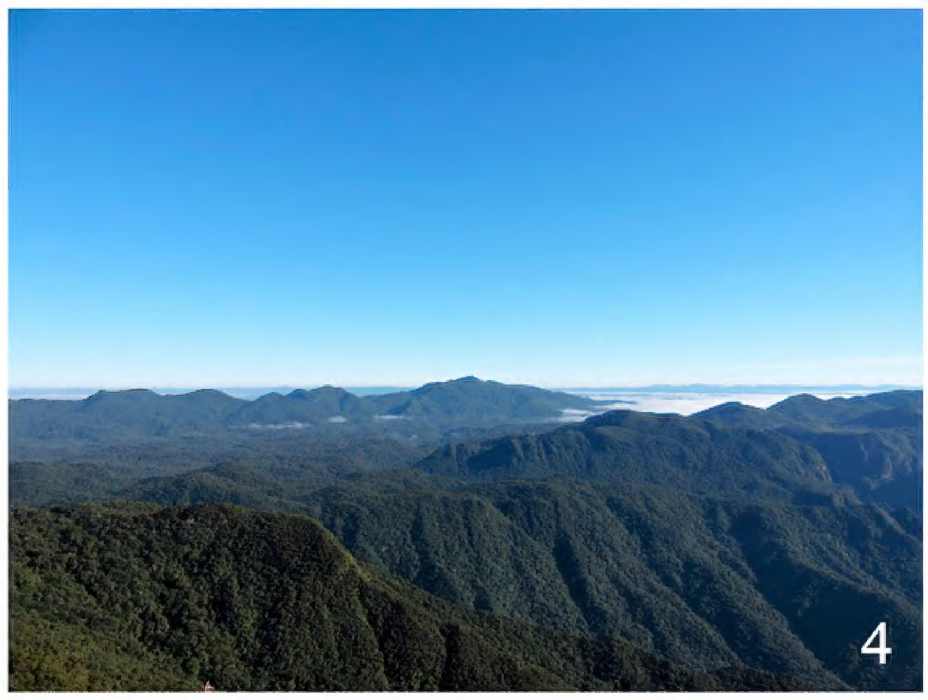
***Cheilolejeunea caducifolia* (Gradst. & Schäf.-Verw.) W. Ye & R.L. Zhu**

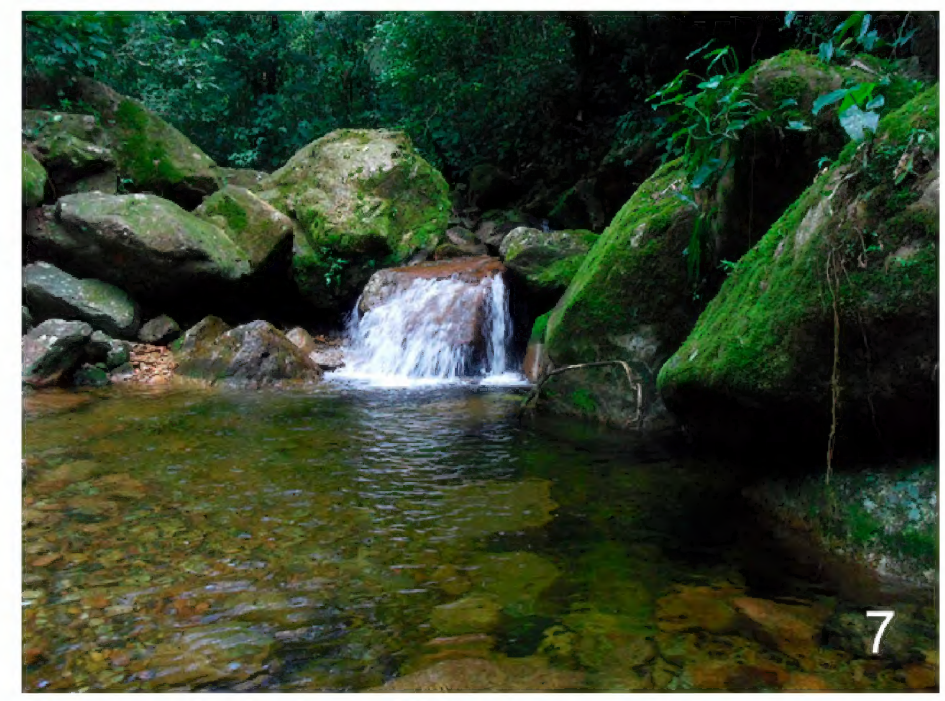
Comments: distinguished by caducous leaves. Habitat: corticicolous. Geographic distribution: Atlantic Forest. Brazilian geographic distribution: BA, ES, MG.

***Cololejeunea manaosensis* (Herzog) O. Yano** (Fig. 42)

Comments: characterized by a smooth cuticle and opaque lobe cells (not transparent). Habitat: epiphyllous.







Figures 2–7. Studied area. **2.** Marumbi peaks group. **3–6.** Overview of the Pico do Marumbi State Park. **7.** Taquaral River.

Geographic distribution: Amazon and Atlantic Forest. Brazilian geographic distribution: AM, MT, PA, SP.

***Cololejeunea microscopica* (Taylor) Schiffn.**

Comments: conical protuberances restricted to the keel and sometimes a few apical cells of the lobe, never exceeding 10 μm in the height. Habitat: epiphyllous and decomposing tree trunks. Geographic distribution: Atlantic Forest. Brazilian geographic distribution: SP.

***Cololejeunea papilliloba* (Steph.) Steph.**

Comments: characterized by elongate-ovate leaves with obtuse apexes; perianth elongate-obconoidal, with well-developed beak; female bracts as long as, or longer than, perianth. Habitat: corticicolous. Geographic distribution: Atlantic Forest and Pampa. Brazilian geographic distribution: MG, RS, SP.

***Fissidens pseudoplurisetus* Bordin, Pursell & O. Yano**

Comments: characterized by limbate leaves, limbidia bi- or tri-stratose, unipapillose cells and 1–4 perichaetial sporophytes. Habitat: corticicolous. Geographic distribution: Atlantic Forest. Brazilian geographic distribution: SP.

***Fissidens yanoae* Pursell.**

Comments: characterized by terminal sporophytes

with short seta and long perichaetial leaves. Habitat: corticolous. Geographic distribution: Atlantic Forest (montane). Brazilian geographic distribution: RS, SP.

***Holomitrium nitidum* Herzog.**

Comments: characterized by elongate laminal cells and long perichatial leaves exceeding the capsule (Herzog 1925). Habitat: corticicolous. Geographic distribution: Atlantic Forest (submontane and montane). Brazilian geographic distribution: ES, MG, PR, RJ, SC, SP.

***Isotachis inflata* Steph.**

Comments: recognized by bordered leaves. Habitat: wet soil. Geographic distribution: Atlantic Forest. Brazilian geographic distribution: ES, PR, RJ.

***Leiomela bartramioides* (Hook. f.) Paris** (Fig. 9)

Comments: smaller stem and perichatial leaves, 5 and 15 mm, respectively, usually half the size of *Leiomela piligera* (Hampe); always found with sporophyte; globose capsule present totally covered with leaves. Habitat: corticicolous, generally in bracken fern-like caudex. Geographic distribution: Atlantic Forest (submontane and high montane). Brazilian geographic distribution: MG, RJ, SP.

***Lejeunea cristulata* (Steph.) E. Reiner & Goda**

Comments: characterized by perianth keel without lacinia, occasionally with cilia; plants 0.7–0.9 mm wide; lobule inflated throughout, free margin involute, apex tooth cell 20–25 μm long. Habitat: corticicolous. Geographic distribution: Atlantic Forest. Brazilian geographic distribution: BA, ES, MG, PE, PR, RJ, RS, SC, SP.

***Lejeunea oligoclada* Spruce**

Comments: at first glance resembles a small species of *Cheilolejeunea* due to dull greenish color, long lobule tooth, and thick leaf cell walls; also resembles *Lejeunea phyllobola* Nees & Mont., but the latter is larger (0.6–1.1 mm wide), and with the leaf lobe apex widely rounded; plants pale and yellowish or light green. Habitat: corticicolous and decomposing tree trunks. Geographic distribution: Atlantic Forest. Brazilian geographic distribution: AL, BA, ES, MG, PE, PR, RJ, SC, SP.

***Lepidopilidium brevisetum* (Hampe) Broth.**

Comments: distinguished by leaves with acute apexes, margin serrate at the apexl and entire toward the base; costa reaching approximately ½ of the leaf length. Habitat: corticolous. Geographic distribution: Atlantic Forest (lowlands to montane) Brazilian geographic distribution: AL, ES, MG, RJ, RS, SC, SP.

***Lepidopilum caudicaule* Müll. Hal.**

Comments: distinguished by serrulate leaf margin at the apex and entire to sinuous toward the base. Habitat: moist rocks. Geographic distribution: Atlantic Forest (lowlands to high montane). Brazilian geographic distribution: PE, RJ, RS, SC.

***Leptodontium viticulosoides* (P. Beauv.) Wijk & Margad.** (Fig. 30)

Comments: characterized by serrate leaves with small laminal papillae; generally hemispherical and homogeneous spores. Habitat: soil, corticicolous, decomposing tree trunks and rocks. Geographic distribution: Atlantic Forest (lowlands to high montane). Brazilian geographic distribution: BA, ES, MG, PR, RJ, RS, SC, SP.

***Leskeodon aristatus* (Geh. & Hampe) Broth.** (Fig. 13)

Comments: characterized by complanate, elliptical to orbicular oblong leaves, slightly revolute when dry, oval-lanceolate, 2.0–3.0 mm, margin entire or denticulate above and apex apiculate. Habitat: corticicolous, sometimes epiphyllous. Geographic distribution: Atlantic Forest (submontane and high montane). Brazilian geographic distribution: MG, PR, RJ, RS, SC, SP.

***Leucoloma triforme* (Mitt.) A. Jaeger**

Comments: characterized by predominantly rectangular to elongated, obliquely-oriented alar cells. Habitat: rocks. Geographic distribution: Atlantic Forest (lowlands to montane). Brazilian geographic distribution: ES, PR, RJ, SP.

***Metzgeria bahiensis* Schiffn.**

Comments: similar to *M. convoluta* Steph., but differs by costa formed by 4–6 rows of ventral epidermal cells; verrucous cuticle; male branch smaller than female branch; external development of female casing absent, stalk vegetative; *M. brasiliensis* differs by costa formed by 2 or 3 rows of ventral epidermal cells; 10–19 lamina formed by cells; occasional rhizoids on ventral surface of lamina; 6–7(–8) medulla cells; cuticle verrucous; marginal cells differentiated; male branch with rhizoids; external development of the female casing absent; stalk vegetative. Habitat: corticicolous. Geographic distribution: Atlantic Forest and Pampa. Brazilian geographic distribution: BA, RS, SP.

***Metzgeria brasiliensis* Schiffn.**

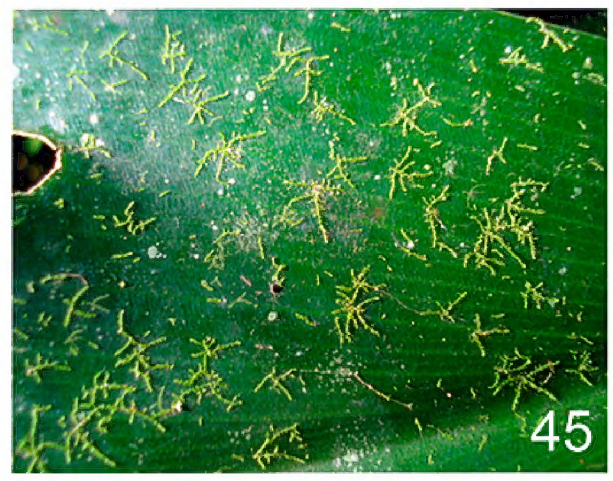
Comments: similar to *Metzgeria aurantiaca* Steph., *Metzgeria convoluta* Steph. and *Metzgeria cratoneura* Schiffn. by having cells of verrucous lamina and medulla with thickened walls. *Metzgeria aurantiaca* differs by possessing rhizoids on the ventral surface of the lamina and on the margin, non-differentiated margin of the cells and male stem smaller than the female; *Metzgeria convoluta* differs by costa formed by 4 (–6) rows of ventral epidermal cells, rhizoids on uniform margin, male stem smaller than the female stem and male branch without rhizoids. Habitat: corticicolous, epiphyllous and rocks. Geographic distribution: Atlantic Forest. Brazilian geographic distribution: AL, BA, PR, RJ, RS, SC, SP.

***Paranapiacabaea paulista* W.R. Buck & Vital.**

Comments: can only be identified with sporophyte; sterile resembles *Donnellia*, when fertile resembles *Pterogoniopsis cylindrical* Müll. Hal., but this latter genus has a higher basal membrane, various super-alar cells and leaves with a flat edge. Habitat: corticicolous. Geographic distribution: Atlantic Forest (submontane to montane). Brazilian geographic distribution: PR, SP.

Figures 8–22. 8. *Dendroceros crispus* (Sw.) Nees. **9.** *Leiomela bartramioides* (Hook. f.) Paris. **10.** *Brachythecium poadelphus* Müll. Hal. **11.** *Rosulabryum densifolium* (Brid.) Ochyra. **12.** *Syrrhopodon prolifer* Schwägr. **13.** *Leskeodon aristatus* (Geh. & Hampe) Broth. **14.** *Holomitrium arboreum* Mitt. **15.** *Leucoloma serrulatum* Brid. **16.** *Fissidens asplenioides* Hedw. **17.** *Chryso-hypnum diminutivum* (Hampe) W.R. Buck. **18.** *Hypopterygium tamariscinum* (Hedw.) Brid. **19.** *Orthostichella pachygastrella* (Müll. Hal. ex Ångstr.) B.H. Allen & Magill. **20.** *Campylopus heterostachys* (Hampe) A. Jaeger. **21.** *Leucobryum albicans* (Schwägr.) Lindb. **22.** *Toloxis imponderosa* (Taylor) W.R. Buck.

Figures 23–37. 23. *Porotrichum substriatum* (Hampe) Mitt. **24.** *Thamnomalia glabella* (Hedw.) S. Olsson et al. **25.** *Macrocoma tenuis* (Hook. f. & Grev.) Vitt. **26.** *Schlotheimia tecta* Hook. f. & Wilson. **27.** *Lepidopilum muelleri* (Hampe) Mitt. **28.** *Thamniopsis langsdorffii* (Hook. f.) W.R. Buck. **29.** *Polytrichum commune* Hedw. **30.** *Leptodontium viticulosoides* (P. Beauv.) Wijk & Margad. **31.** *Acroporium estrellae* (Müll. Hal.) W.R. Buck & Schäf.-Verw. **32.** *Sematophyllum galipense* (Müll. Hal.) Mitt. **33.** *Sphagnum palustre* L. **34.** *Aneura pinguis* (L.) Dumort. **35.** *Isotachis aubertii* (Schwägr.) Mitt. **36.** *Odontoschisma falcifolium* Steph. **37.** *Frullania brasiliensis* Raddi.



Figures 38–52. 38. *Syzygiella anomala* (Lindenb. & Gott.) Steph. **39.** *Chiloscyphus martianus* (Nees) J.J. Engel & R.M. Schust. **40.** *Bryopteris filicina* (Sw.) Nees. **41.** *Cheilolejeunea clausa* (Nees & Mont.) R.M. Schuster. **42.** *Cololejeunea manaosensis* (Herzog) O.Yano. **43.** *Diplasiolejeunea brunnea* Steph. **44.** *Lejeunea flava* (Sw.) Nees. **45.** *Microlejeunea epiphylla* Bischl. **46.** *Taxilejeunea pterigonia* (Lehm. & Lindb.) Schiffn. **47.** *Bazzania hookeri* (Lindb.) Trevis. **48.** *Lepidozia inaequalis* Lehm. & Lindb. **49.** *Metzgeria albinea* Spruce. **50.** *Symphyogyna brasiliensis* Nees. **51.** *Plagiochila adiantoides* Dumort. **52.** *Radula recubans* Taylor.

***Polytrichum angustifolium* Mitt.**

Comments: distinguished by pyriform lamella of cells in cross section, vaginate sometimes with orange flat-edged sheath. Habitat: soil, rocks and humus. Geographic distribution: Atlantic Forest (submontane to high montane). Brazilian geographic distribution: ES, MG, PR, RJ, RS, SC, SP.

***Porotrichum thieleanum* (Müll. Hal.) Mitt.**

Comments: characterized by stipe with squarrose leaves with recurved margin and stem leaves orbicular. Habitat: corticicolous. Geographic distribution: Atlantic Forest (submontane). Brazilian geographic distribution: MG, PR, RJ, RS, SP.

***Prionolejeunea scaberula* (Spruce) Steph.**

Comments: margins of caducous leaves can be strongly crenate with marginal cells evolving to rhizoids. Habitat: corticicolous, epiphyllous, and rocks. Geographic distribution: Amazonian and Atlantic Forest. Brazilian geographic distribution: AM, BA, MA, SP.

***Radula brasilica* Yamada**

Comments: characterized by recurved free margin of lobules; leaf cells with large trigones. Habitat: decomposing tree trunks. Geographic distribution: Atlantic Forest. Brazilian geographic distribution: SP.

***Rhacocarpus inermis* (Mull. Hal.) Lindb.**

Comments: distinguished by oblong-lanceolate leaves with short acute apexes that are cuspidate or when piliferous with the upper margin not bordered. Habitat: exposed, moist or soil covered rocks. Geographic distribution: Atlantic Forest (montane to high montane). Brazilian geographic distribution: ES, MG, RJ, RS, SC.

***Riccardia emarginata* (Steph.) Hell.**

Comments: related to *R. regnelli* but differs by having a thicker axis (9–12 cells thick; 5–7 cells thick in *R. regnelli*) and a subepidermis in the axis (subepidermis lacking in *R. regnelli*). Habitat: soil and corticicolous. Brazilian geographic distribution: BA, MG, RJ, SP.

***Riccardia regnellii* (Ångstr.) Hell.**

Comments: related to *R. emarginata*. Habitat: soil, decomposing tree trunks and corticicolous. Geographic distribution: Atlantic Forest. Brazilian geographic distribution: BA, ES, MG, MT, PE, RJ, RN, RS, SC, SP.

***Sphagnum divisum* H.A. Crum**

Comments: with 1 or 2 fasciculate branches, large leaves of branches with annular pores commissurally arranged in continuous rows on both surfaces, and leucocyst stem leaves consistently divided with more numerous pores on internal than external surface. Habitat: soil and rocks. Geographic distribution: Atlantic Forest (montane and high montane) and Cerrado. Brazilian geographic distribution: BA, GO, MG, RJ, SC.

***Sphagnum exquisitum* H.A. Crum**

Comments: similar to *S. ramulinum,* but possessing smaller leaves, oval branches, and fibrillous leucocysts only on upper portions of both stem leaves and branches. Habitat: soil and rocks. Geographic distribution: Atlantic Forest (submontane to high montane). Brazilian geographic distribution: MG, PR, RJ, SP.

***Sphagnum globicephalum* Müll. Hal. ex Warnst.**

Comments: characterized by possessing a simple stem and sparse branches with terminal globular structures formed by groups of imbricate leaves; stem leaves and branches are similar with few or numerous pores on both surfaces. Habitat: dry soil. Geographic distribution: Atlantic Forest (montane to high montane). Brazilian geographic distribution: RJ, SC.

***Sphagnum multiporosum* H.A. Crum**

Comments: characterized by branches in fascicles of three; leaves broad-elliptic, broad-rounded apex, apex smooth, sometimes fringy or bordered by a reabsorption furrow; leucocyst of leaves of branches on outer surface with group of 3 conspicuous pores at adjacent angles; chlorocyst elliptical. Habitat: soil and rocks. Geographic distribution: Atlantic Forest and Pampa. Brazilian geographic distribution: BA, MG, RJ, RS, SP.

***Sphagnum pseudoramulinum* H.A. Crum**

Comments: similar to *S. ramulinum* in Southeast Brazil, however, the pores of the external surface of the stem leaves and branches are large and arranged in a commissural row, leucoscysts of stem leaves are divided and secondary branches grow near base. Habitat: soil and rocks. Geographic distribution: Atlantic Forest (high montane). Brazilian geographic distribution: RJ, RS, SP.

***Sphagnum sucrei* H.A. Crum**

Comments: stem leaves large, oblong, with no divided hyaline cells and numerous pores in commissural rows on external surface, but absent on internal surface, contrasting in size and shape with leaves of the branches, which possess a similar pore distribution; the chlorocyst of the leaves of the branches are narrowly trapezoidal in cross-section, more widely exposed on the internal surface. Habitat: rocks. Geographic distribution: Atlantic Forest. Brazilian geographic distribution: MG, RJ.

***Trichocolea argentea* Herzog.**

Comments: characterized by lamina of the leaf with scattered cilia on the surface. Habitat: soil, rocks, and decomposing tree trunks. Geographic distribution: Amazonia, Caatinga, Cerrado, Atlantic Forest, Pampa and Pantanal. Brazilian geographic distribution: PR, RJ, SC, SP.

***Trichosteleum glaziovii* (Hampe) W.R. Buck**

Comments: is distinguished by falcate leaves. Habitat: corticicolous and decomposing tree trunks. Geographic distribution: Atlantic Forest (lowlands to high montane). Brazilian geographic distribution: MG, PE, PR, RJ, SC, SP.

Table 1. List of bryophyte species found in cloud forest of Pico do Marumbi State Park with their geographic distribution in Brazil. Dist. Brazil = distribution in Brazil, EN = Endemic, RA = Rare, MO = Moderate and AM = Wide. Voucher information**.** DFP = Denilson Fernandes Peralta; DMC = Dimas Marchi do Carmo; ELS = Emanuele Lais dos Santos; GTF = G.T. Ferreira; LAA = Leandro de Almeida Amelio; RR = Rony Ristow; and WTF = W.T. Ferreira.

Taxon	Dist. Brazil	Brazilian states	Voucher	Coordinates
Anthocerothophyta				
Dendrocerotaceae				
Dendroceros crispus (Sw.) Nees (Swartz 1788: 146, Nees 1846: 581) (Fig. 8)	MO	BA, MG, PR, RJ, SP	DFP 16094 (SP452520)	25°26′11″ S, 48°55′14″W
Nothoceros minarum (Nees) J.C. Villarreal (Nees 1838: 340, Villarreal A. 2014: 34)	MO	PE, RJ, RS, SP	DFP 16016 (SP452439)	25°26′11″ S, 48°55′14″W
Bryophyta				
Bartramiaceae				
Breutelia subtomentosa (Hampe) A. Jaeger (Hampe 1872: 49, Jaeger 1875: 94)	MO	ES, MG, PR, RJ, RS, SC, SP	DFP 17925 (SP461467)	25°30′55″ S, 48°58′58″W
Leiomela bartramioides (Hook. f.) Paris (Hooker 1836: 71, Paris 1905: 132) (Fig. 9)	RA/EN	MG, RJ, SP	DFP 16120 (SP 452546)	25°26′11″ S, 48°55′14″W
Philonotis hastata (Duby) Wijk & Argent (Duby 1846: 132, Wijk & Margadant 1959: 74)	AM	AM, BA, CE, GO, MA, MG, MS, MT, PA, PI, PR, RJ, RO, RS, SP	DFP 15946 (SP452368)	25°26′55″ S, 48°54′54″W
Philonotis sphaerocarpa (Hedw.) Brid.(Hedwig 1801: 197, Bridel 1827: 25)	MO	AM, BA, CE, MT, RJ, SC, SP	ELS 379 (SP477549)	25°15′57″ S, 48°32′42″W
Brachytheciaceae				
Brachythecium poadelphus Müll. Hal., 1901 (Fig. 10)	RA/EN	MG, RJ, SP	DFP 16823 (SP460357)	25°26′15″ S, 48°55′09″
Meteoridium remotifolium (Müll. Hal.) Manuel (Müller 1846: 216, Manuel 1977: 49)	AM	BA, ES, GO, MG, MT, PB, PE, PR, RJ, RR, RS, SC, SP	DFP 16804 (SP460338)	25°27′00″ S, 48°55′05″W
Squamidium brasiliense (Hornsch.) Broth. (Horschuch 1840: 52, Brotherus 1906: 809)	MO	BA, ES, MG, PR, RJ, RS, SC, SP	DFP 16819 (SP460353)	25°26′15″ S, 48°55′09″W
Squamidium leucotrichum (Taylor) Broth. (Taylor 1848: 196, Brotherus 1906: 809)	AM	AC, AL, AM, BA, CE, ES, MG, PA, PE, PR, RJ, RO, RR, RS, SC, SP	WTF 35 (SP437089)	25°27′14″ S, 48°55′12″W
Squamidium nigricans (Hook. f.) Broth. (Hooker 1822: 64, Brotherus 1906: 808)	MO	AP, CE, ES, PE, PR, RJ, RS, SC	DFP 16249 (SP454827)	25°26′11″ S, 48°55′14″W
Zelometeorium patens (Hook. f.) Manuel (Hooker 1818: 56, Manuel 1977: 116)	MO	ES, MG, MT, RJ, SP	DFP 16254 (SP454832)	25°26′11″ S, 48°55′14″W
Zelometeorium patulum (Hedw.) Manuel (Hedwig 1801: 279, Manuel 1977: 116)	AM	AC, AL, AM, AP, BA, CE, ES, GO, MG, MS, MT, PA, PE, PR, RJ, RO, RR, RS, SC, SP, TO	RR 2852 (SP438301)	25°27′14″ S, 48°55′12″W
Bryaceae				
Brachymenium patulum (Müll. Hal.) Schimp. (Müller 1851: 579, Schimper in Bescherelle 1872: 195)	RA	ES, MG, SP	DFP 15991 (SP452413)	25°26′55″ S, 48°54′54″W
Bryum alpinum Huds. ex With., 1801	RA	RS, SP	ELS 260 (SP459068)	25°30′49″ S, 48°59′20″W
Bryum limbatum Müll. Hal., 1851	MO	DF, ES, MG, MS, PR, RJ, RS, SC, SP	RR s.n. (SP462188)	25°26′57″ S, 48°54′50″W
Rhodobryum roseolum (Müll. Hal.) Paris (Müller 1879: 287, Paris 1898: 1120)	MO	RJ, SC, SP	ELS 539 (SP477711)	25°18′20″ S, 48°35′09″W
Rhodobryum roseum (Hedw.) Limpr. (Hedwig 1801: 194-195, Limpricht 1892: 445)	RA	PE, RJ, RN	ELS 263 (SP459071)	25°30′49″ S, 48°59′20″W
Rhodobryum subverticillatum Broth., 1924	MO	BA, MG, PA, PE, RJ, SC, SP	DFP 17921 (SP461463)	25°30′55″ S, 48°58′58″W
Rosulabryum billarderii (Schwär) J.R. Spence (Schwägrichen 1826: 76, Spence 1996: 223)	AM	AM, BA, DF, ES, GO, MA, MG, MS, MT, PA, PE, PR, RJ, RO, RR, RS, SC, SP	DFP 16000 (SP452422)	25°26′11″ S, 48°55′14″W
Rosulabryum densifolium (Brid.) Ochyra (Bridel 1827: 855, Ochyra 2003: 162) (Fig. 11)	AM	BA, DF, ES, MG, PE, PR, RJ, RS, SC, SP	DFP 16240 (SP454818)	25°26′11″ S, 48°55′14″W
Rosulabryum huillense (Welw. & Duby) Ochyra (Welwitsch & Duby in Duby 1872: 220, Ochyra 2003: 162)	RA	MG, RJ, SP	ELS 342 (SP477512)	25°15′57″ S, 48°32′42″W
Calymperaceae				
Syrrhopodon elongatus Sull., 1861	MO	BA, PR, RJ, RS, SC, SP	ELS 269 (SP459077)	25°30′50″ S, 48°59′16″W
Syrrhopodon gardneri (Hook. f.) Schwägr. (Hooker 1819: 146, Schwägrichen 1824: 110)	MO	AM, BA, GO, MG, MT, RJ	ELS 247 (SP459055)	25°30′49″ S, 48°59′20″W
Syrrhopodon incompletus Schwägr., 1824	AM	AC, AM, AP, BA, DF, GO, MG, MS, MT, PA, PE, PR, RJ, RO, RR, SC, SP, TO	DFP 16063 (SP452487)	25°26′11″ S, 48°55′14″W
Syrrhopodon ligulatus Mont., 1856	AM	AC, AM, AP, BA, DF, GO, MG, MS, MT, PA, PE, RJ, RO, RR, SP	DFP 16248 (SP454826)	25°26′11″ S, 48°55′14″W
Syrrhopodon prolifer Schwägr., 1827 (Fig. 12)	AM	AL, AM, AP, BA, CE, DF, ES, GO, MG, MT, PA, PE, PI, PR, RJ, RO, RS, SC, SE, SP, TO	ELS 264 (SP459072)	25°30′50″ S, 48°59′16″W
Syrrhopodon prolifer var *cincinnatus* (Hampe) W.D. Reese (Hampe 1874: 131, Reese 1978: 200)	MO	BA, DF, ES, GO, MG, MT, PA, PI, PR, RJ, RO, RS, SC, SP	RR s.n. (SP462176)	25°26′49″ S, 48°54′53″W
Syrrhopodon prolifer var *tenuifolius* (Sull.) W.D. Reese (Sullivant 1861: 280, Reese 1978: 199)	MO	BA, ES, MG, RJ, RS, SC, SP	RR s.n. (SP462179)	25°26′49″ S, 48°54′53″W
Syrrhopodon tortilis Hampe, 1872	MO	MG, RJ, RS, SC, SP	ELS 294 (SP477464)	25°15′57″ S, 48°32′42″W

Table 1. *Continued.*

Taxon	Dist. Brazil	Brazilian states	Voucher	Coordinates
Catagoniaceae				
Catagonium nitens (Brid.) Cardot (Bridel 1812: 50, Cardot 1915: 469)	RA	AM, MG, SC	DFP 17933 (SP461475)	25°30′55″ S, 48°58′58″ W
Daltoniaceae				
Daltonia bilimbata Hampe, 1863	RA	MG, PR, RJ, SP	DFP 16267 (SP454846)	25°26′11″ S, 48°55′14″ W
Daltonia splachnoides (Sm.) Hook. & Tayl. (Smith 1813: 36, Hooker & Taylor 1818: 80)	AM	BA, ES, MG, PE, SP	DFP 17851 (SP461393)	25°30′55″ S, 48°58′58″ W
Leskeodon aristatus (Geh. & Hampe) Broth. (Geheeb & Hampe 1879, Brotherus 1907: 926) (Fig. 13)	MO/EN	MG, PR, RJ, RS, SC, SP	DFP 16057 (SP452481)	25°26′11″ S, 48°55′14″ W
Dicranaceae				
Dicranella exigua (Schwägr.) Mitt. (Schwägrichen 1827: 93, Mitten 1869: 30)	MO	AM, ES, MG, MT, PA, PR, RJ, RS, SC, SP	DFP 17743 (SP461284)	25°27′10″ S, 48°55′11″ W
Dicranella hilariana (Mont.) Mitt. (Montagne 1839: 52, Mitten 1860: 31)	AM	AC, AM, AP, BA, CE, ES, GO, MA, MG, MS, MT, PA, PB, PE, RJ, RO, RR, RS, SC, SP, TO	ELS 285 (SP477455)	25°15′57″ S, 48°32′42″ W
Dicranella lindigiana Hampe, 1869	MO	CE	DFP 15721 (SP452143)	25°26′55″ S, 48°54′54″ W
Dicranella varia (Hedw.) Schimp. (Hedwig 1801: 133, Schimper 1855: 13)	MO	CE, GO, SP	ELS 383 (SP477553)	25°15′57″ S, 48°32′42″ W
Dicranodontium pulchoalare Broth subsp *brasiliense* (Herzog) J.-P Frahm (Herzog 1927: 254, Frahm 1997: 196)	RA	RJ	ELS 283 (SP477453)	25°15′57″ S, 48°32′42″ W
Dicranoloma billarderii (Brid. ex Anon) Paris (Bridel 1802: 214, Paris 1904: 24)	RA	RS, SC	ELS 449 (SP 477620)	25°15′57″ S, 48°32′42″ W
Holomitrium arboreum Mitt., 1869 (Fig. 14)	AM	AM, BA, ES, GO, MG, MT, PA, PE, PR, RJ, RO, RR, RS, SP	RR 2849 (SP438300)	25°27′14″ S, 48°55′12″ W
Holomitrium crispulum Mart., 1834	AM	AM, BA, ES, GO, MG, PE, PR, RJ, RS, SC, SP	ELS 354 (SP477524)	25°15′57″ S, 48°32′42″ W
Holomitrium nitidum Herzog, 1924	MO/EN	ES, MG, PR, RJ, SC, SP	DFP 17665 (SP461206)	25°27′10″ S, 48°55′11″ W
Holomitrium olfersianum Hornsch., 1840	AM	ES, MG, MT, PR, RJ, RS, SC, SP	LAA 59 (SP464601)	25°26′55″ S, 48°54′54″ W
Leucoloma cruegerianum (Müll. Hal.) A. Jaeger (Müller 1851: 588, Jaeger 1872: 412)	MO	AL, BA, ES, GO, MG, PE, PR, RJ, SP	ELS 287 (SP477457)	25°15′57″ S, 48°32′42″ W
Leucoloma serrulatum Brid., 1827 (Fig. 15)	MO	AL, BA, DF, ES, MG, PE, PR, RJ, SP	ELS 290 (SP477460)	25°15′57″ S, 48°32′42″ W
Dicranaceae				
Leucoloma triforme (Mitt.) A. Jaeger (Mitten 1869: 94, Jaeger 1872: 413)	RA/EN	ES, PR, RJ, SP	ELS 286 (SP477456)	25°15′57″ S, 48°32′42″ W
Diphysciaceae				
Diphyscium longifolium Griff. (Griffith 1842: 477)	MO	AM, MT, RJ, RO, SP	DFP 15791 (SP452213)	25°26′55″ S, 48°54′54″ W
Ditrichaceae				
Rhamphidium dicranoides (Müll. Hal.) Paris (Müller 1851: 612, Paris 1905: 164)	RA	RJ	DFP 16073 (SP452497)	25°26′11″ S, 48°55′14″ W
Fissidentaceae				
Fissidens asplenioides Hedw., 1801 (Fig. 16)	MO	BA, MG, MT, PB, PR, RJ, RS, SC, SP	DFP 15950 (SP452372)	25°26′55″ S, 48°54′54″ W
Fissidens bryoides Hedw., 1801	RA	PE, PR, SP	RR s.n. (SP462175)	25°26′13″ S, 48°55′19″ W
Fissidens elegans Brid., 1806	AM	AC, AM, BA, CE, DF, ES, GO, MA, MG, MS, MT, PA, PB, PE, PI, PR, RJ, RO, RR, RS, SC, SP	ELS 492 (SP477664)	25°16′16″ S, 48°33′04″ W
Fissidens guianensis Mont., 1840	AM	AC, AL, AM, BA, CE, ES, MA, MG, MS, MT, PA, PB, PE, PI, RO, RR, RS, SP, TO	DFP 17625 (SP461165)	25°26′08″ S, 48°55′16″ W
Fissidens hornschuchii Mont., 1840	AM	AM, BA, CE, DF, ES, GO, MA, MG, MS, MT, PA, PB, PE, PI, RJ, RO, RS, SC, SP	DFP 17750 (SP461291)	25°27′10″ S, 48°55′11″ W
Fissidens oediloma Müll. Hal. ex Broth., 1895	MO	ES, MG, PR, RJ, RS, SC, SP	DFP 16176 (SP452602)	25°26′11″ S, 48°55′14″ W
Fissidens pellucidus Hornsch., 1840	AM	AC, AM, BA, CE, DF, ES, GO, MG, MT, PA, PB, PE, PR, RJ, RO, RR, RS, SC, SP, TO	DFP 17690 (SP461231)	25°27′10″ S, 48°55′11″ W
Fissidens pseudoplurisetus Bordin *et al.*, 2011	RA/EN	SP	DFP 15988 (SP452410)	25°26′55″ S, 48°54′54″ W
Fissidens scariosus Mitt., 1869	AM	BA, ES, MA, MG, PA, PB, PE, PR, RJ, RO, RS, SC, SP	DFP 16238 (SP454816)	25°26′11″ S, 48°55′14″ W
Fissidens serratus Müll. Hal., 1847	AM	AM, BA, CE, ES, GO, MG, MT, PE, PI, RJ, RS, SC, SP	DFP 16268 (SP454847)	25°26′11″ S, 48°55′14″ W
Fissidens submarginatus Bruch in Krauss, 1846	AM	AC, AM, BA, CE, DF, ES, GO, MA, MG, MT, PA, PB, PE, PI, RJ, RN, RO, RS, SC, SP	RR s.n. (SP462187)	25°26′57″ S, 48°54′50″ W
Fissidentaceae				
Fissidens weirii Mitt., 1869	MO	GO, MG, PR, RJ, SC, SP	DFP 15928 (SP452350)	25°26′55″ S, 48°54′54″ W
Fissidens yanoae Pursell, 1994	RA/EN	RS, SP	DFP 16815 (SP460349)	25°26′15″ S, 48°55′09″ W
Funariaceae				
Entosthodon bonplandii (Hook. f.) Mitt. (Hooker 1816: 1B, Mitten 1869: 245)	MO	ES, GO, MG, PE, PI, RJ, RS, SC, SP	DFP 16793 (SP460327)	25°27′00″ S, 48°55′05″ W

Table 1. *Continued.*

Taxon	Dist. Brazil	Brazilian states	Voucher	Coordinates
Hedwigiaceae				
Braunia subincana Broth., 1900	RA	PR, RS	RR 2835 (SP437116)	25°27′14″ S, 48°55′12″ W
Hedwigidium integrifolium (P. Beauv.) Dixon (Palisot de Beauvois 1805: 60, Dixon 1939: 369)	MO	ES, MG, PE, PR, RJ, RS, SC	DFP 17868 (SP461410)	25°30′55″ S, 48°58′58″ W
Hypnaceae				
Chryso-hypnum diminutivum (Hampe) W.R. Buck (Hampe 1847: 86-87, Buck 1984: 182) (Fig. 17)	AM	AC, AM, AP, BA, DF, ES, GO, MG, MS, MT, PA, PE, PR, RJ, RO, RR, RS, SC, SP, TO	DFP 16766 (SP460300)	25°27′00″ S, 48°55′05″ W
Mittenothamnium reduncum (Mitt.) Ochyra (Mittenr 1869: 509, Ochyra 1999: 256)	MO	ES, MG, PR, RJ, RS, SC	ELS 479 (SP477651)	25°16′16″ S, 48°33′04″ W
Phyllodon truncatulus (Müll. Hal.) W.R. Buck (Müller 1851: 263, Buck 1987: 521)	MO	AC, AM, ES, MG, MT, PR, RJ, SC, SP	DFP 16196 (SP454774)	25°26′11″ S, 48°55′14″ W
Puiggariopsis aurifolia (Mitt.) M. Menzel (Mitt 1869: 509, Menzel 1992: 239)	RA	SP	ELS 527 (SP477699)	25°18′20″ S, 48°35′09″ W
Taxiphyllum ligulaefolium (E.B. Bartram) W.R. Buck (Bartram 1946: 123, Buck 1990: 42)	AM	AM, GO	ELS 378 (SP477548)	25°15′57″ S, 48°32′42″ W
Hypopterygiaceae				
Hypopterygium tamariscinum (Hedw.) Brid. (Hedwig 1801: 212-214, Bridel 1851: 8) (Fig. 18)	MO	BA, ES, MG, PR, RJ, RS, SC, SP	DFP 16022 (SP452445)	25°26′11″ S, 48°55′14″ W
Lopidium concinnum (Hook. f.) Wilson (Hooker 1818: 34, Wilson 1854: 119)	MO	ES, MG, PA, PR, RJ, RS, SC, SP	DFP 16195 (SP454773)	25°26′11″ S, 48°55′14″ W
Lembophyllaceae				
Orthostichella pachygastrella (Müll. Hal. ex Ångström) B.H.Allen & Magill (Müller 1876: 33, Allen & Magill 2007) (Fig. 19)	MO	MG, PR, RJ, RS, SC, SP	RR 4242 (SP458461)	25°26′57″ S, 48°55′53″ W
Orthostichella versicolor (Müll. Hal.) B.H. Allen & W.R. Buck (Müller 1850: 127, Allen & Buck 2003: 140)	AM	AM, ES, MG, PE, PR, RJ, RO, RS, SC, SP	DFP 16818 (SP460352)	25°26′15″ S, 48°55′09″ W
Pilotrichella flexilis (Hedw.) Ångstr. (Hedwig 1801: 234, Ångström 1876: 34)	AM	AP, BA, ES, MG, MS, MT, PE, PR, RJ, RS, SC, SP	ELS 349 (SP477519)	25°15′57″ S, 48°32′42″ W
Leucobryaceae				
Atractylocarpus brasiliensis (Müll. Hal.) R.S. Willians (Müller 1898: 39, Williams 1928: 110)	RA/EN	BA, RJ	DFP 15841 (SP452263)	25°26′55″ S, 48°54′54″ W
Campylopus arctocarpus (Hornsch.) Mitt. (Hornschuch 1840: 12, Mitten 1869: 87)	AM	BA, ES, GO, MG, MT, PE, PI, PR, RJ, RS, SC, SP	ELS 295 (SP477465)	25°15′57″ S, 48°32′42″ W
Campylopus cryptopodioides Broth., 1900	AM	AP, DF, ES, GO, MG, MS, MT, PR, RJ, RS, SC, SP	DFP 15735 (SP452157)	25°26′55″ S, 48°54′54″ W
Campylopus cuspidatus (Hornsch.) Mitt. (Hornschuch 1840: 13, Mitten 1869: 90)	MO	BA, MG, RJ	RR s.n. (SP462186)	25°26′57″ S, 48°54′50″ W
Campylopus dichrostis (Mull. Hal.) Paris. (Müller 1900: 255, Paris 1901: 333)	MO/EN	BA, GO, MG, RJ, RS, SC, SP	ELS 319 (SP477489)	25°15′57″ S, 48°32′42″ W
Campylopus filifolius (Hornsch.) Mitt. (Hornschuch 1840: 12, Mitt 1869: 76)	AM	BA, ES, MG, PE, PR, RJ, RS, SC, SP	DFP 16165 (SP452591)	25°26′11″ S, 48°55′14″ W
Campylopus flexuosus (Hedw.) Brid. (Hedwig 1801: 38, Bridel 1819: 71)	RA	PE, RJ, SP, RS	ELS 303 (SP477473)	25°15′57″ S, 48°32′42″ W
Campylopus fragilis (Brid.) Bruch & Schimp. (Bridel 1801: 296, Buch & Schimper 1847: 164)	RA/EN	MG, RJ, SC, SP	ELS 267 (SP459075)	25°30′50″ S, 48°59′16″ W
Campylopus heterostachys (Hampe) A. Jaeger (Hampe 1865: 581, Jaeger 1872: 421) (Fig. 20)	AM	BA, CE, ES, GO, MA, MG, MT, PE, PI, PR, RJ, RR, RS, SP	ELS 252 (SP459060)	25°30′49″ S, 48°59′20″ W
Campylopus julaceus A. Jaeger, 1880	MO	BA, MG, PR, RJ, RS, SC, SP	DFP 17948 (SP461490)	25°30′55″ S, 48°58′58″ W
Campylopus lamellinervis (Müll. Hal.) Mitt. (Müller 1848: 390, Mitten 1869: 82)	AM	BA, ES, MG, PE, PI, PR, RJ, RS, SC, SP	ELS 248 (SP459056)	25°30′49″ S, 48°59′20″ W
Campylopus occultus Mitt., 1869	AM	AP, BA, DF, ES, GO, MA, MG, MS, MT, PA, PE, PR, RJ, RR, RS, SC, SP	DFP 17906 (SP461448)	25°30′55″ S, 48°58′58″ W
Campylopus pilifer Brid., 1819	AM	AL, AM, BA, CE, DF, ES, MG, MT, PA, PE, PR, RJ, RR, RS, SP	ELS 282 (SP477452)	25°15′57″ S, 48°32′42″ W
Campylopus richardii Brid., 1819	AM	AM, BA, CE, ES, MG, PE, PR, RJ, RR, RS, SC, SP	ELS 373 (SP477543)	25°15′57″ S, 48°32′42″ W
Campylopus savannarum (Müll. Hal.) Mitt. (Müller 1851: 596, Mitten 1869: 85)	AM	AM, BA, CE, ES, GO, MA, MG, MS, MT, PA, PE, PI, PR, RJ, RO, RR, SE, SP, TO	ELS 291 (SP477461)	25°15′57″ S, 48°32′42″ W
Campylopus subcuspidatus (Hampe) A. Jaeger (Hampe 1870: 273, Jaeger 1872: 441)	RA	RJ, SP	ELS 255 (SP459063)	25°30′49″ S, 48°59′20″ W
Campylopus thwaitesii (Mitt.) A. Jaeger (Mitten 1859: 19, Jaeger 1872: 417)	AM	AM, BA, DF, MG, RJ, RS, SC, SP	ELS 534 (SP477706)	25°18′20″ S, 48°35′09″ W
Leucobryum albicans (Schwägr.) Lindb. (Schwägrichen 1827: 122, Lindberg 1863: 402) (Fig. 21)	AM	BA, CE, DF, ES, MG, MT, PA, PE, PR, RJ, RS, SC, SP	ELS 284 (SP477454)	25°15′57″ S, 48°32′42″ W
Leucobryum crispum Müll. Hal., 1848	AM	AM, AP, BA, CE, DF, ES, GO, MG, MT, PA, PR, RJ, RO, RR, RS, SC, SP, TO	ELS 301 (SP477471)	25°15′57″ S, 48°32′42″ W
Leucobryum giganteum Müll. Hal., 1848	AM	AL, AM, BA, ES, MG, PE, PR, RJ, RS, SC, SP	ELS 310 (SP477480)	25°15′57″ S, 48°32′42″ W
Leucomiaceae				
Leucomium strumosum (Hornsch.) Mitt. (Hornschuch 1840: 69, Mitten 1869: 502)	AM	AC, AL, AM, AP, ES, MG, PA, PE, RJ, RO, RR, SC, SP	DFP 16066 (SP452490)	25°26′11″ S, 48°55′14″ W

Table 1. *Continued.*

Taxon	Dist. Brazil	Brazilian states	Voucher	Coordinates
Meteoriaceae				
Toloxis imponderosa (Taylor) W.R. Buck (Taylor 1846: 62, Buck 1994: 436) (Fig. 22)	RA	MG, RJ, RS	DFP 15753 (SP452175)	25°26′55″ S, 48°54′54″ W
Trachypus bicolor Reinw. & Hornsch., 1829	RA	RJ	DFP 15784 (SP452206)	25°26′55″ S, 48°54′54″ W
Mniaceae				
Epipterygium immarginatum Mitt., 1869	RA	SC	DFP 16186 (SP454764)	25°26′11″ S, 48°55′14″ W
Pohlia tenuifolia (Mitt.) A. Jaeger (Jaeger 1875: 137, Brotherus 1903: 549)	RA	RJ, SP	DFP 16778 (SP460312)	25°27′00″ S, 48°55′05″ W
Neckeraceae				
Thamnobryum fasciculatum (Sw. ex Hedw.) I. Sastre (Swartz 1801: 245, Sastre-de Jesús 1993: 232)	AM	ES, MG, PR, RJ, RS, SC, SP	RR s.n. (SP462182)	25°26′59″ S, 48°54′51″ W
Homaliodendron piniforme (Brid.) Enroth (Bridel 1827: 260, Enroth 1990: 551)	MO	BA, PE, RJ, SC, SP	DFP 16771 (SP460305)	25°27′00″ S, 48°55′05″ W
Isodrepanium lentulum (Wilson) E. Britton (Wilson 1847: 379, Britton 1914: 28)	RA	BA, RJ, RO, SP	DFP 16216 (SP454794)	25°26′11″ S, 48°55′14″ W
Neckera villae-ricae Besch., 1877	MO	MS, PR, RJ, RS, SC, SP	DFP 16043 (SP452467)	25°26′11″ S, 48°55′14″ W
Porotrichodendron superbum (Taylor) Broth. (Taylor 1846: 61, Brotherus 1916: 120)	RA	PR, RS, SC	DFP 15818 (SP452240)	25°26′55″ S, 48°54′54″ W
Porotrichum filiferum Mitt., 1869	RA	ES, MG, MT, RJ, SP	DFP 15873 (SP452295)	25°26′55″ S, 48°54′54″ W
Porotrichum korthalsianum (Dozy & Molk.) Mitt. (Dozy & Monlkenboer 1854: 42, Mitten 1869: 463)	MO	MG, PE, RJ, RS, SP	DFP 15939 (SP452361)	25°26′55″ S, 48°54′54″ W
Porotrichum lancifrons (Hampe) Mitt. (Hampe 1863: 158, Mitten 1869: 462)	MO	ES, MG, PR, RJ, RS, SC, SP	DFP 16070 (SP452494)	25°26′11″ S, 48°55′14″ W
Porotrichum longirostre (Hook. f.) Mitt. (Hooker 1818: 1, Mitten 1869: 461)	MO	MG, MS, MT, PE, RJ, RS, SC, SP	DFP 15777 (SP452199)	25°26′55″ S, 48°54′54″ W
Porotrichum mutabile Hampe, 1862	MO	MG, PE, RJ, RS, SC	DFP 17844 (SP461386)	25°30′55″ S, 48°58′58″ W
Porotrichum substriatum (Hampe) Mitt. (Hampe 1866: 340, Mitten 1869: 463) (Fig. 23)	AM	AC, AL, AM, BA, MT, PA, PE, RJ, RO, RR, RS, SC, SP	DFP 15729 (SP452151)	25°26′55″ S, 48°54′54″ W
Porotrichum thieleanum (Müll. Hal.) Mitt. (Müller 1851: 227, Mitten 1869: 465)	MO/EN	MG, PR, RJ, RS, SP	DFP 15750 (SP452172)	25°26′55″ S, 48°54′54″ W
Thamnomalia glabella (Hedw.) S. Olsson *et al.* (Hedwig 1801: 235, Olsson et al. 2011: 46) (Fig. 24)	RA	BA, RJ, SC, SP	DFP 15778 (SP452200)	25°26′55″ S, 48°54′54″ W
Orthotrichaceae				
Groutiella tumidula (Mitt.) Vitt (Mitten 1869: 201, Vitt 1979: 9)	AM	AC, AM, BA, CE, ES, MT, PA, PR, RJ, RO, SP	GTF 6 (SP438161)	25°26′55″ S, 48°55′03″ W
Macrocoma tenuis (Hook. f. & Grev.) Vitt (Hooker & Greville 1824: 120, Vitt 1973: 217) (Fig. 25)	MO	GO, PR, RS, SP	DFP 17875 (SP461417)	25°30′55″ S, 48°58′58″ W
Macromitrium argutum Hampe, 1849	MO	MG, PR, RJ, RS, SC, SP	DFP 17918 (SP461460)	25°30′55″ S, 48°58′58″ W
Macromitrium cirrosum (Hedw.) Brid. (Hedwig 1801: 42, Bridel 1826: 316)	AM	AM, AP, BA, CE, MG, PA, PR, RJ, RS, SC, SP	DFP 16727 (SP460261)	25°27′00″ S, 48°55′05″ W
Macromitrium microstomum (Hook. f. & Grev.) Schwägr. (Hooker & Greville 1824: 114, Schwägrichen 1827: 130)	RA	MG, PR, RJ, SP	DFP 16785 (SP460319)	25°27′00″ S, 48°55′05″ W
Macromitrium richardii Schwägr., 1826	AM	AM, BA, DF, ES, MG, PE, PR, RJ, RS, SC, SP	DFP 16164 (SP452590)	25°26′11″ S, 48°55′14″ W
Schlotheimia jamesonii (Arn.) Brid. (Arnott 1823: 349, Bridel 1826: 742)	AM	AC, BA, DF, ES, GO, MA, MG, MS, PE, PR, RJ, RS, SC, SP	DFP 17945 (SP461487)	25°30′55″ S, 48°58′58″ W
Schlotheimia rugifolia (Hook. f.) Schwägr. (Hooker 1819: 128, Schwägrichen 1824: 150)	AM	AC, AM, BA, CE, DF, ES, GO, MG, MT, PA, PE, PR, RJ, RO, RS, SC, SP	LAA 13 (SP464555)	25°27′10″ S, 48°55′11″ W
Schlotheimia tecta Hook. f. & Wilson (Fig. 26)	MO	CE, ES, MG, PR, RJ, RS, SC, SP	ELS 254 (SP459062)	25°30′49″ S, 48°59′20″ W
Schlotheimia torquata (Sw. ex Hedw.) Brid. (Swartz 1801: 246, Bridel 1812: 16)	AM	AM, BA, MG, PE, PR, RJ, RR, RS, SC, SP	ELS 258 (SP459066)	25°30′49″ S, 48°59′20″ W
Phyllogoniaceae				
Phyllogonium viride Brid., 1827	AM	AL, BA, CE, ES, MG, PE, PR, RJ, RS, SC, SP	ELS 328 (SP477498)	25°15′57″ S, 48°32′42″ W
Pilotrichaceae				
Callicostella merkelii (Hornsch.) A. Jaeger (Hornschuch 1840: 62, Jaeger 1877: 255)	AM	AC, AM, BA, CE, GO, MG, PA, PE, RJ, RR, SC, SP	DFP 17672 (SP461213)	25°27′10″ S, 48°55′11″ W
Callicostella pallida (Hornsch.) Ångstr. (Hornschuch 1840: 64, Ångstgröm 1876: 27)	AM	AC, AL, AM, AP, BA, CE, DF, ES, GO, MG, MS, MT, PA, PE, PR, RJ, RN, RO, RR, RS, SC, SE, SP, TO	DFP 16003 (SP452425)	25°26′11″ S, 48°55′14″ W
Callicostella rufescens (Mitt.) A. Jaeger (Mitten 1869: 352, Jaeger 1877: 355)	MO	AL, AM, PA, PE, RJ	DFP 16036 (SP452460)	25°26′11″ S, 48°55′14″ W
Cyclodictyon varians (Sull.) Kuntze (Sullivant 1861: 285-286, Kuntze 1891: 835)	MO	MS, PR, RJ, SC, SP	DFP 16184 (SP454762)	25°26′11″ S, 48°55′14″ W
Hypnella pilifera (Hook. f. & Wilson) A. Jaeger (Hooker 1844: 160, Jaeger 1877: 270)	MO	ES, MG, PB, PR, RJ, RS, SC, SP	ELS 382 (SP477552)	25°15′57″ S, 48°32′42″ W
Lepidopilidium brevisetum (Hampe) Broth. (Hampe 1878: 266, Brotherus 1907: 944)	MO/EN	AL, ES, MG, RJ, RS, SC, SP	DFP 15986 (SP452408)	25°26′55″ S, 48°54′54″ W
Lepidopilidium nitens (Hornsch.) Broth. (Hornschuch 1840: 65, Brotherus 1907: 944)	MO	MG, PR, RJ, RN, RS, SC, SP	DFP 17651 (SP461192)	25°27′10″ S, 48°55′11″ W
Lepidopilum caudicaule Müll. Hal., 1900	RA/EN	PE, RJ, RS, SC	ELS 377 (SP477547)	25°15′57″ S, 48°32′42″ W
Lepidopilum muelleri (Hampe) Hampe (Hampe 1847: 84, Hampe 1865: 365) (Fig. 27)	MO	AL, MG, PE, RJ, RS, SP	DFP 17682 (SP461223)	25°27′10″ S, 48°55′11″ W

Table 1. *Continued.*

Taxon	Dist. Brazil	Brazilian states	Voucher	Coordinates
Lepidopilum ovalifolium (Duby) Broth. (Duby 1880: 172, Brotherus 1895: 34)	MO	PR, RJ, RS, SC, SP	DFP 15900 (SP452322)	25°26′55″ S, 48°54′54″W
Thamniopsis cruegeriana (Mull. Hal.) W.R. Buck (Müller 1851: 208, Buck 1987: 218)	RA	AM, MT	DFP 16111 (SP452537)	25°26′11″ S, 48°55′14″W
Thamniopsis incurva (Hornsch.) W.R. Buck (Hornschuch 1840: 65, Buck 1987: 218)	AM	AM, BA, ES, MG, PA, PB, PE, PR, RJ, RS, SC, SP	DFP 16243 (SP454821)	25°26′11″ S, 48°55′14″W
Thamniopsis langsdorffii (Hook. f.) W.R. Buck (Hooker 1819: 17, Buck 1987: 218) (Fig. 28)	MO	CE, ES, MG, PR, RJ, RN, RS, SC, SP	ELS 330 (SP477500)	25°15′57″ S, 48°32′42″W
Thamniopsis undata (Hedw.) W.R. Buck (Hedwig 1801: 52, Buck 1987: 219)	AM	BA, ES, MG, MT, PR, RJ, RN, SC, SP	DFP 17897 (SP461439)	25°30′55″ S, 48°58′58″W
Trachyxiphium guadalupense (Spreng.) W.R. Buck (Sprengel 1812: 96, Buck 1987: 220)	MO	ES, MG, MS, PR, RJ, RS, SC, SP	ELS 329 (SP477499)	25°15′57″ S, 48°32′42″W
Trachyxiphium saxicola (R.S. Willians) Vaz-Imbassahy & D.P. Costa (Williams 1909: 248, Vaz-Imbassahy & Costa 2009: 472)	MO	AL, MG, MT, RJ, RN, RS	DFP 15860 (SP452282)	25°26′55″ S, 48°54′54″W
Plagiomniaceae				
Plagiomnium rhynchophorum (Harv.) T.J. Kop. (Harvey 1836: 20, Koponen 1971: 57)	MO	AP, ES, GO, MG, PR, RJ, RS, SC, SP	DFP 16812 (SP460346)	25°26′15″ S, 48°55′09″W
Polytrichaceae				
Polytrichum angustifolium Mitt., 1869	MO/EN	ES, MG, PR, RJ, RS, SC, SP	DFP 16222 (SP454800)	25°26′11″ S, 48°55′14″W
Polytrichum commune Hedw., 1801 (Fig. 29)	AM	AM, BA, DF, ES, GO, MG, PR, RJ, RO, RR, RS, SC, SP	RR 4253 (SP458470)	25°26′57″ S, 48°55′53″W
Polytrichum juniperinum Hedw., 1801	AM	BA, DF, ES, GO, MG, PR, RJ, RO, RR, RS, SC, SP, TO	DFP 16253 (SP454831)	25°26′11″ S, 48°55′14″W
Pottiaceae				
Barbula riograndensis E.B. Bartram, 1952	RA/EN	PR, RS	DFP 15907 (SP452329)	25°26′55″ S, 48°54′54″W
Leptodontium viticulosoides (P. Beauv.) Wijk & Margad. (Palisot de Beauvois 1805: 78, Wijk & Margadant 1960: 51) (Fig. 30)	MO/EN	BA, ES, MG, PR, RJ, RS, SC, SP	DFP 17924 (SP461466)	25°30′55″ S, 48°58′58″W
Tortella humilis (Hedw.) Jenn.(Hedwig 1801: 116-117, Jennings 1913: 96)	AM	BA, DF, ES, GO, MA, MG, MS, PE, PR, RJ, RS, SC, SP	DFP 16075 (SP452499)	25°26′11″ S, 48°55′14″W
Pterobryaceae				
Orthostichopsis praetermissa W.R. Buck, 1991	RA	AM, BA, MA	DFP 15775 (SP15775)	25°26′55″ S, 48°54′54″W
Pterobryaceae				
Orthostichopsis tortipilis (Müll. Hal.) Broth. (Brotherus 1925: 150, Müller 1855: 768)	MO	AM, AP, BA, ES, MG, PE, RJ, SP	DFP 15793 (SP452215)	25°26′55″ S, 48°54′54″W
Pterobryon densum Hornsch., 1840	MO	BA, ES, MG, PR, RJ, RS, SC, SP	DFP 15965 (SP452387)	25°26′55″ S, 48°54′54″W
Ptychomniaceae				
Ptychomnion cygnisetum (Müll. Hal.) Kindberg (Müller 1885: 425, Kindberg 1888: 31)	MO	PR, RJ, RS, SC	ELS 528 (SP477700)	25°18′20″ S, 48°35′09″W
Pylaisiadelphaceae				
Isopterygium tenerifolium Mitt., 1869	AM	AM, BA, CE, DF, GO, MG, MT, PA, PR, RJ, RO, RS, SC, SP	DFP 16237 (SP454815)	25°26′11″ S, 48°55′14″W
Rhacocarpaceae				
Rhacocarpus inermis (Mull. Hal.) Lindb. (Müller 1862: 382, Lindberg 1891: 22)	MO/EN	ES, MG, RJ, RS, SC	RR s.n. (SP462191)	25°26′57″ S, 48°54′50″W
Rhacocarpus purpurascens (Brid.) Paris (Bridel 1812: 121, Paris 1900: 292)	MO	ES, MG, PR, RJ, RS, SC	ELS 314 (SP477484)	25°15′57″ S, 48°32′42″W
Rhizogoniaceae				
Hymenodon aeruginosus (Hook.f. & Wilson) Müll. Hal. (Hooker & Wilson 1844: 154, Müller 1847: 804)	MO	ES, MG, PR, RJ, RS, SC, SP	RR s.n. (SP462183)	25°26′59″ S, 48°54′51″W
Pyrrhobryum spiniforme (Hedw.) Mitt. (Hedwig 1801: 236-237, Mitten 1868: 174)	AM	AM, BA, ES, MG, MT, PE, PR, RJ, RO, RR, RS, SC, SP	ELS 526 (SP477698)	25°18′20″ S, 48°35′09″W
Sematophyllaceae				
Acroporium caespitosum (Hedw.) W.R. Buck (Hedwig 1802: 233, Buck 1983: 310)	MO	DF, MT, PB, PR, RS	DFP 16006 (SP452428)	25°26′11″ S, 48°55′14″W
Acroporium estrellae (Müll. Hal.) W.R. Buck & Schäf.-Verw. (Müller 1851: 275, Buck & Schäfer-Verwimp 1991: 646) (Fig. 31)	AM	BA, DF, GO, MG, PA, PR, RJ, RS, SC, SP	DFP 15773 (SP452195)	25°26′55″ S, 48°54′54″W
Aptychella proligera (Broth.) Herzog (Brotherus 1908: 1115, Herzog 1916: 157)	RA	MG, RJ, SC	DFP 16764 (SP460298)	25°27′00″ S, 48°55′05″W
Aptychopsis pyrrhophylla (Müll.Hal.) Wijk & Margad. (Müller 1851: 344, Wijk & Margadant 1959: 71)	MO/EN	AM, BA, ES, MG, RJ, SP	DFP 17693 (SP461234)	25°27′10″ S, 48°55′11″W
Aptychopsis pungifolia (Hampe) Broth. (Hampe 1879: 152, Brotherus 1925: 411)	MO	BA, MG, PE, RJ, SP	DFP 15744 (SP452166)	25°26′55″ S, 48°54′54″W
Paranapiacabaea paulista W.R. Buck & Vital, 1992	RA/EN	PR, SP	DFP 16109 (SP452535)	25°26′11″ S, 48°55′14″W
Sematophyllum beyrichii (Hornsch.) Broth. (Hornchuch 1840: 81, Brotherus 1925: 431)	AM	BA, DF, ES, GO, MA, MG, PE, PR, RJ, SP	DFP 17860 (SP461402)	25°30′55″ S, 48°58′58″W
Sematophyllum galipense (Müll. Hal.) Mitt. (Müller 1848: 780, Mitten 1869: 480) (Fig. 32)	AM	BA, CE, DF, ES, GO, MA, MG, MT, PA, PR, RJ, RS, SC, SP, TO	ELS 316 (SP477486)	25°15′57″ S, 48°32′42″W
Sematophyllum lithophilum (Hornsch.) Ångstr. (Hornschuch 1840: 84, Ångström 1876: 42)	RA	MG, MT, RJ, RS	DFP 17735 (SP461276)	25°27′10″ S, 48°55′11″W
Sematophyllum subdepressum (Hampe) Broth. (Hampe 1878: 270, Brotherus 1925: 433)	MO	MT, PR, RJ, RS, SC, SP	DFP 16730 (SP460264)	25°27′00″ S, 48°55′05″W
Sematophyllum subsimplex (Hedw.) Mitt. (Hedwig 1801: 69, Mitten 1869: 494)	AM	AC, AL, AM, AP, BA, CE, DF, ES, GO, MA, MG, MS, MT, PA, PE, PI, PR, RJ, RO, RR, RS, SC, SE, SP, TO	ELS 257 (SP459065)	25°30′49″ S, 48°59′20″W

Table 1. *Continued.*

Taxon	Dist. Brazil	Brazilian states	Voucher	Coordinates
Trichosteleum glaziovii (Hampe) W.R. Buck (Hampe 1874: 174, Buck 1998: 243)	MO/EN	MG, PE, PR, RJ, SC, SP	ELS 318 (SP477488)	25°15′57″ S, 48°32′42″W
Trichosteleum hornschuchii (Hampe) A. Jaeger (Hampe 1844: 9, Jaeger 1878: 418)	AM	AM, BA, MT, PA, PI, PR, RJ, SP	ELS 375 (SP477545)	25°15′57″ S, 48°32′42″W
Trichosteleum sentosum (Sull.) A. Jaeger (Sullivant 1861: 288, Jaeger 1878: 415)	MO	AM, BA, PA, PE, PR, RJ	DFP 17666 (SP461207)	25°27′10″ S, 48°55′11″W
Wijkia flagellifera (Broth.) H.A. Crum (Brotherus 1895: 54, Crum 1971: 172)	MO	BA, ES, MG, PE, PR, RJ, RS, SC, SP	DFP 16077 (SP452502)	25°26′11″ S, 48°55′14″W
Sphagnaceae				
Sphagnum cyclophyllum Sull. & Lesq. in Gray, 1856	MO	BA, ES, GO, MG, PR, RJ, SC, SP	DFP 15762 (SP452184)	25°26′55″ S, 48°54′54″W
Sphagnum divisum H.A. Crum, 1992	MO/EN	BA, GO, MG, RJ, SC	DFP 16786 (SP460320)	25°27′00″ S, 48°55′05″W
Sphagnum exquisitum H.A. Crum, 1992	RA/EN	MG, PR, RJ, SP	DFP 15866 (SP452288)	25°26′55″ S, 48°54′54″W
Sphagnum globicephalum Müll. Hal. ex Warnst., 1911	RA/EN	RJ, SC	DFP 15899 (SP452321)	25°26′55″ S, 48°54′54″W
Sphagnum multiporosum H.A. Crum, 1987	MO/EN	BA, MG, RJ, RS, SP	DFP 17721 (SP461262)	25°27′10″ S, 48°55′11″W
Sphagnum ovalifolium Warnst., 1891	RA	GO, MG	DFP 15738 (SP452160)	25°26′55″ S, 48°54′54″W
Sphagnum palustre L., 1753 (Fig. 33)	AM	AM, AP, BA, CE, ES, GO, MG, MS, PA, PB, PE, PR, RJ, RO, RR, RS, SC, SE, SP	RR s.n. (SP462180)	25°26′49″ S, 48°54′53″W
Sphagnum perichaetiale Hampe, 1848	AM	AM, AP, CE, DF, ES, MG, MS, MT, PA, PB, PE, PR, RJ, RO, RR, RS, SC, SE, SP	DFP 15864 (SP452286)	25°26′55″ S, 48°54′54″W
Sphagnum pseudoramulinum H.A. Crum, 1987	RA/EN	RJ, RS, SP	DFP 15819 (SP452241)	25°26′55″ S, 48°54′54″W
Sphagnum strictum Sull., 1846	RA	BA, ES	DFP 17659 (SP461200)	25°27′10″ S, 48°55′11″W
Sphagnum subsecundum Nees in Sturm, 1819	AM	BA, DF, ES, GO, MG, MT, PR, RJ, RO, RS, SC, SP, TO	RR 2834 (SP437115)	25°27′14″ S, 48°55′12″W
Sphagnum sucrei H.A. Crum, 1987	RA/EN	MG, RJ	RR s.n. (SP462185)	25°26′57″ S, 48°54′50″W
Sphagnum tenellum (Brid.) Brid., 1819	RA	AM, RJ	DFP 15854 (SP452276)	25°26′55″ S, 48°54′54″W
Symphyodontaceae				
Symphyodon imbricatifolius (Mitt.) S.P. Churchill (Mitten 1869: 372, Churchill 1994: 194)	RA	GO, MG, RJ	DFP 16256 (SP454834)	25°26′11″ S, 48°55′14″W
Thuidiaceae				
Thuidiopsis furfurosa (Hook. f. & Wilson) M. Fleisch. (Hooker & Wilson 1854: 10, Fleischer 1923: 1497)	AM	ES, MG, PR, RJ, RS, SC, SP	DFP 17848 (SP461390)	25°30′55″ S, 48°58′58″W
Thuidium brasiliense Mitt., 1869	MO	MG, PR, RJ, RS, SC, SP	DFP 16817 (SP460351)	25°26′15″ S, 48°55′09″W
Thuidium delicatulum (Hedw.) Bruch & Schimp. (Hedwig 1801: 26-261, Schimper 1852: 164)	AM	AM, BA, GO, MG, MT, PA, PR, RJ, RS, SC, SP	ELS 530 (SP477702)	25°18′20″ S, 48°35′09″W
Thuidium tomentosum Besch., 1872	AM	AL, AM, BA, ES, GO, MG, MS, MT, PA, PE, PR, RJ, RO, RR, RS, SC, SP	DFP 16203 (SP454781)	25°26′11″ S, 48°55′14″W
Marchantiophyta				
Acrobolbaceae				
Tylimanthus laxus (Lehm. & Lindb.) Spruce (Lindenberg 1841: 68, Stephani 1885: 502)	MO	ES, MS, MT, PR, RJ, SP	DFP 17755 (SP461297)	25°27′10″ S, 48°55′11″W
Adelanthaceae				
Adelanthus decipiens (Hook.) Mitt. (Hooker 1813: 50, Mitten 1864: 244)	MO	BA, ES, MG, PR, RJ	RR 2803 (SP437094)	25°27′14″ S, 48°55′12″W
Aneuraceae				
Aneura pinguis (L.) Dumort. (Linnaeus 1753: 1136, Dumortier 1831: 86) (Fig. 34)	AM	AL, AM, ES, MG, MS, PA, PR, RJ, SC, SP	DFP 16118 (SP452544)	25°26′11″ S, 48°55′14″W
Riccardia chamedryfolia (With.) Grolle (Withering 1776: 699, Grolle 1969: 772)	MO	DF, ES, GO, MG, MT, PR, RJ, RS, SP	ELS 338 (SP477508)	25°15′57″ S, 48°32′42″W
Riccardia digitiloba (Spruce ex Steph.) Pagán (Spruce 1888: 276, Pagán 1939: 6)	AM	AC, AM, BA, CE, ES, MG, MS, MT, PE, RJ, SP	ELS 546 (SP477718)	25°18′20″ S, 48°35′09″W
Riccardia emarginata (Steph.) K.G. Hell (Stephani 1893: 20, Hell 1969: 100)	RA/EN	BA, MG, RJ, SP	ELS 250 (SP459058)	25°30′49″ S, 48°59′20″W
Riccardia fucoides (Sw.) C. Massal. (Swartz 1788: 145, Massalongo 1885: 256)	RA	BA, ES, RJ, SP	DFP 17660 (SP461201)	25°27′10″ S, 48°55′11″W
Riccardia glaziovii (Spruce) Meenks (Spruce 1889: 201, Meenks 1987: 173)	MO	AP, BA, ES, PA, PR, RJ, RS, SC, SP	ELS 365 (SP477535)	25°15′57″ S, 48°32′42″W
Riccardia regnellii K.G. Hell, 1969	AM/EN	BA, ES, MG, MT, PE, RJ, RN, RS, SC, SP	DFP 16072 (SP16072)	25°26′11″ S, 48°55′14″W
Balantiopsidaceae				
Isotachis aubertii (Schwägr.) Mitt. (Schwägrichen 1814: 19, Mitten 1887: 322) (Fig. 35)	MO	ES, MG, PR, RJ, RS, SC, SP	RR 2806 (SP438273)	25°27′14″ S, 48°55′12″W
Isotachis inflata Steph., 1903	RA/EN	ES, PR, RJ	ELS 488 (SP477660)	25°16′16″ S, 48°33′04″W
Isotachis multiceps (Lindb. & Gottsche) Gottsche (Lindenberg & Gottsche 1847: 687, Gottsche 1863: 105)	MO	ES, PR, RJ, RS, SP	DFP 17697 (SP461238)	25°27′10″ S, 48°55′11″W
Neesioscyphus bicuspidatus (Nees) Grolle (Stephani 1901: 471, Grolle 1966: 182)	RA	MG	DFP 16239 (SP454817)	25°26′11″ S, 48°55′14″W
Neesioscyphus homophyllus (Nees) Nees (Nees von Esenbeck in Martius 1833: 336, Grolle 1964: 188)	RA	BA, MG, RJ, SP	DFP 17891 (SP461433)	25°30′55″ S, 48°58′58″W
Calypogeiaceae				
Calypogeia peruviana Nees & Mont., 1838	AM	AC, AL, AM, BA, DF, GO, MG, PE, PR, RJ, RS, SC, SP	DFP 16058 (SP452482)	25°26′11″ S, 48°55′14″W
Mnioloma caespitosum (Spruce) R.M. Schuster (Spruce 1885: 412, Schuster 1995: 839)	RA	AM	DFP 16777 (SP460311)	25°27′00″ S, 48°55′05″W

Table 1. *Continued.*

Taxon	Dist. Brazil	Brazilian states	Voucher	Coordinates
Mnioloma cyclostipum (Spruce) R.M. Schuster (Spruce 1885: 411, Schuster 1995: 843)	RA	RJ, SC	DFP 15820 (SP452242)	25°26′55″ S, 48°54′54″ W
Cephaloziaceae				
Fuscocephaloziopsis crassifolia (Lindenb. & Gottsche) Váňa & L. Söderstr.	RA	BA, ES, MG, PR, RJ, RS, SP	DFP 17889 (SP461431)	25°30′55″ S, 48°58′58″ W
Odontoschisma denudatum (Nees) Dumort. (Nees von Esenbeck in Martius 1817: 14, Dumortier 1835: 19)	AM	AM, BA, MT, PE, RJ, SC, SP	ELS 251 (SP459059)	25°30′49″ S, 48°59′20″ W
Odontoschisma falcifolium Steph., 1908 (Fig. 36)	RA	AM, BA, ES, GO, MG, MT, RJ, SP	DFP 15761 (SP452183)	25°26′55″ S, 48°54′54″ W
Odontoschisma longiflorum (Taylor) Steph. (Taylor 1846: 281, Trevisan 1877: 419)	MO	BA, ES, GO, MG, MT, PR, RJ, SP	ELS 246 (SP459054)	25°30′49″ S, 48°59′20″ W
Herbertaceae				
Herbertus acanthelius Spruce, 1885	MO	MG, RJ, RS, SC	WTF 39 (SP437099)	25°27′14″ S, 48°55′12″ W
Herbertus bivittatus Spruce, 1885	MO	BA, CE, PE, RJ	DFP 17756 (SP461298)	25°27′10″ S, 48°55′11″ W
Herbertus pensilis Spruce, 1885	RA	RJ	DFP 17729 (SP461270)	25°27′10″ S, 48°55′11″ W
Frullaniaceae				
Frullania atrata (Sw.) Dumort. (Swartz 1788: 144, Dumortier 1835: 13)	AM	AM, BA, MG, PA, PE, PR, RJ, RS, SC, SP	ELS 327 (SP477497)	25°15′57″ S, 48°32′42″ W
Frullania beyrichiana (Lehm. & Lindenb.) Lehm. & Lindenb. (Lehmann & Lindenberg in Lehmann 1833: 25, Lehmann & Lindenberg 1845: 460)	MO	AC, BA, ES, GO, MG, MT, PA, PE, RJ, RS, SP	RR s.n. (SP462184)	25°26′59″ S, 48°54′51″ W
Frullania brasiliensis Raddi, 1822 (Fig. 37)	AM	BA, CE, DF, ES, GO, MG, PE, RJ, RS, SC, SP	ELS 274 (SP459082)	25°30′50″ S, 48°59′16″ W
Frullania breuteliana Gottsche, 1845	MO	BA, PE, RJ, RS, SP	ELS 326 (SP477496)	25°15′57″ S, 48°32′42″ W
Frullania caulisequa (Nees) Nees (Ness von Esenbeck 1833: 373, Montagne 1839: 51)	AM	AC, AL, BA, CE, DF, ES, GO, MG, MT, PA, PB, PE, RJ, RR, RS, SC, SE, SP	DFP 16139 (SP452565)	25°26′11″ S, 48°55′14″ W
Frullania curvilobula Schäf.-Verw. et al., 2012	RA	PR, SP	DFP 16126 (SP452552)	25°26′11″ S, 48°55′14″ W
Frullania flexicaulis Spruce, 1884	RA	SC, SP	DFP 17650 (SP461191)	25°27′10″ S, 48°55′11″ W
Frullania kunzei (Lehm. & Lindb.) Lehm. & Lindb. (Lehmann & Lindenberg 1834: 50, Lehmann & Lindenberg 1845: 449)	AM	AC, AM, BA, CE, DF, ES, GO, MG, MT, PA, PB, PE, PR, RJ, RR, RS, SC, SE, SP	DFP 16127 (SP452553)	25°26′11″ S, 48°55′14″ W
Frullania setigera Steph., 1894	MO	ES, MG, PR, RJ, RS, SC, SP	DFP 16733 (SP460267)	25°27′00″ S, 48°55′05″ W
Geocalycaceae				
Saccogynidium caldense (Ångstr.) Grolle (Ångström 1876: 80, Grolle 1960: 44)	MO	GO, RJ, SP	ELS 541 (SP477713)	25°18′20″ S, 48°35′09″ W
Jamesoniellaceae				
Syzygiella anomala (Lindenb. & Gott.) Steph. (Lindenberg & Gottsche 1844: 646, Stephani 1902: 190) (Fig. 38)	RA	MG, PR, RJ, SP	DFP 15732 (SP452154)	25°26′55″ S, 48°54′54″ W
Syzygiella contigua (Gottsche) Steph. (Gottsche 1864: 118, Stephani 1902: 470)	MO	RJ, SP	ELS 485 (SP477657)	25°16′16″ S, 48°33′04″ W
Syzygiella integerrima Steph., 1917	RA	ES, MG, RJ	DFP 17656 (SP461197)	25°27′10″ S, 48°55′11″ W
Syzygiella liberata Inoue, 1974	MO	BA, MG, RJ, SC, SP	LAA 73 (SP464615)	25°27′00″ S, 48°55′05″ W
Syzygiella rubricaulis (Nees) Steph. (Nees von Esenbeck in Martius 1833: 34, Stephani 1902: 187)	MO	BA, MG, RJ, RS, SC, SP	ELS 348 (SP477518)	25°15′57″ S, 48°32′42″ W
Lophocoleaceae				
Chiloscyphus muricatus (Lehm.) J.J. Engel & R.M. Schust. (Lehmann 1829: 363, Engel & Schuster 1984: 419)	MO	ES, MG, RJ, RS, SC, SP	DFP 15947 (SP452369)	25°26′55″ S, 48°54′54″ W
Chiloscyphus martianus (Nees) J.J. Engel & R.M. Schust. (Nees von Esenbeck 1845: 152, Engel & Schuster 1984: 419) (Fig. 39)	AM	AM, AP, BA, CE, ES, GO, MG, MT, PA, PE, PR, RJ, RS, SC, SE, SP	DFP 16784 (SP460318)	25°27′00″ S, 48°55′05″ W
Chiloscyphus proteus (Herzog) J.J. Engel & R.M. Schust. (Herzog 1955: 164, Engel & Schuster 1984: 421)	RA	RJ, SP	RR s.n. (SP462182)	25°26′59″ S, 48°54′51″ W
Heteroscyphus valdiviensis (Mont.) Schiffn. (Montagne 1845: 351, Schiffner 1910: 172)	RA	SP	DFP 17674 (SP461215)	25°27′10″ S, 48°55′11″ W
Leptoscyphus amphibolius (Nees) Grolle (Nees von Esenbeck 1833 in Martius: 334, Grolle 1962: 54)	MO	BA, ES, GO, MG, RJ, SP	DFP 15935 (SP452357)	25°26′55″ S, 48°54′54″ W
Leptoscyphus porphyrius (Nees) Grolle (Nees von Esenbeck 1845: 185, Grolle 1969: 3)	MO	ES, MG, PA, PE, PR, RJ, SP	DFP 16726 (SP460260)	25°27′00″ S, 48°55′05″ W
Lejeuneaceae				
Anoplolejeunea conferta (Meissn. ex Spreng.) A. Evans (Spreng 1827: 325, Evans 1908: 175)	AM	AL, BA, ES, MG, PA, PB, PE, PR, RJ, RR, RS, SC, SP	DFP 16207 (SP454785)	25°26′11″ S, 48°55′14″ W
Archilejeunea ludoviciana (De Not. ex Lehm.) Gradst. & Geissler (Lehmann 1857: 11, Gradstein & Geissler 1994: 58)	RA	AM	DFP 15922 (SP452344)	25°26′55″ S, 48°54′54″ W
Brachiolejeunea phyllorhiza (Nees) Kruijt & Gradst. (Nees von Esenbeck 1833 in Martius: 348, Kruijt & Gradstein 1986: 299)	MO	AM, BA, ES, MG, PE, RJ, SP	DFP 15953 (SP452375)	25°26′55″ S, 48°54′54″ W
Bryopteris diffusa (Sw.) Nees (Swartz 1788: 144, Nees von Esenbeck 1845: 286)	AM	AL, AM, BA, CE, ES, MG, MT, PA, PB, PE, PR, RJ, RS, SC, SP	RR 4268 (SP458541)	25°26′57″ S, 48°55′53″ W
Bryopteris filicina (Sw.) Nees (Swartz 1788: 145, Nees von Esenbeck 1845: 284) (Fig. 40)	AM	AL, AM, CE, ES, GO, MG, MS, MT, PA, PE, PR, RJ, RR, RS, SC, SP	DFP 15751 (SP452173)	25°26′55″ S, 48°54′54″ W
Ceratolejeunea confusa R.M. Schuster, 1956	RA	AM, BA, PA, PE, SP	DFP 15713 (SP452135)	25°26′55″ S, 48°54′54″ W
Ceratolejeunea cornuta (Lindb.) Steph. (Lindenberg 1829: 23, Stephani 1895: 65)	MO	AC, AM, AP, CE, MG, PA, PE, PR, RJ, RO, RR, SC, SP	ELS 452 (SP477623)	25°15′57″ S, 48°32′42″ W
Cheilolejeunea acutangula (Nees) Grolle (Nees von Esenbeck 1833 in Martius: 357, Grolle 1979: 173)	AM	AL, AM, BA, DF, ES, GO, MG, MT, PA, PE, RJ, RR, RS, SC, SP	ELS 481 (SP477653)	25°16′16″ S, 48°33′04″ W

Table 1. *Continued.*

Taxon	Dist. Brazil	Brazilian states	Voucher	Coordinates
Cheilolejeunea adnata (Kutze.) Grolle (Kunze 1834: 46, Grolle 1977: 529)	AM	AC, AL, AM, AP, BA, ES, MT, PA, PE, PR, RN, RR, SC, SP	DFP 16087 (SP452513)	25°26′11″ S, 48°55′14″W
Cheilolejeunea caducifolia (Gradst. & Schäf.-Verw.) W. Ye & R.L. Zhu (Gradstein & Schäfer-Verwimp 1993: 64, Ye & Zhu 2010: 280)	RA/EN	BA, ES, MG	DFP 17736 (SP461277)	25°27′10″ S, 48°55′11″W
Cheilolejeunea clausa (Nees & Mont.) R.M. Schuster (Nees von Esenbeck in Montagne 1840: 337, Schuster 1980: 863) (Fig. 41)	AM	AL, AM, BA, CE, ES, GO, MG, MS, MT, PA, PE, PR, RJ, RO, SP	DFP 15801 (SP452223)	25°26′55″ S, 48°54′54″W
Cheilolejeunea holostipa (Spruce) Grolle & R.L. Zhu (Spruce 1884: 171, Grolle & Zhu 2001: 1071)	MO	BA, ES, MG, PA, PE, PR, RJ, SP	DFP 15957 (SP452379)	25°26′55″ S, 48°54′54″W
Cheilolejeunea oncophylla (Ångstr.) Grolle & E. Reiner (Ångström 1876: 86, Grolle & Reiner 1997: 781)	MO	AP, BA, MG, PA, PR, RJ, RR, SC, SP	DFP 15861 (SP452283)	25°26′55″ S, 48°54′54″W
Cheilolejeunea rigidula (Mont.) R.M. Schuster (Montagne 1840: 336, Schuster 1971: 102)	AM	AC, AL, AM, AP, BA, CE, DF, ES, GO, MA, MG, MS, MT, PA, PB, PE, PR, RJ, RR, SC, SE, SP, TO	DFP 17903 (SP461445)	25°30′55″ S, 48°58′58″W
Cheilolejeunea unciloba (Lidenb.) Malombe (Lindenberg 1845: 331, Malombe 2009: 325)	MO	BA, CE, ES, MG, RJ, RS, SP	ELS 538 (SP477710)	25°18′20″ S, 48°35′09″W
Cheilolejeunea xanthocarpa (Lehm. & Lindenb.) Malombe (Lehman & Lindenberg in Lehmann 1833: 8, Malombe 2009: 326)	MO	BA, CE, ES, MG, SP	ELS 540 (SP477712)	25°18′20″ S, 48°35′09″W
Cololejeunea diaphana A. Evans, 1905	AM	AM, ES, GO, MT, PA, PE, RJ, RS, SC, SP	DFP 16233 (SP454811)	25°26′11″ S, 48°55′14″W
Cololejeunea gracilis (Ast.) Pócs (Jovet-Ast 1947: 21, Pócs 2008: 233)	MO	AM, ES, MG, MT, PA, RJ, SP	DMC 1122 (SP455270)	25°26′11″ S, 48°55′14″W
Cololejeunea manaosensis (Herzog) O.Yano (Herzog 1931: 349, Yano 1894: 513) (Fig. 42)	RA/EN	AM, MT, PA, SP	DFP 17685 (SP461226)	25°27′10″ S, 48°55′11″W
Cololejeunea microscopica (Taylor) Schiffn. (Taylor in MacKay 1836: 59, Schiffner in Engler & Prantl 1893: 122)	RA/EN	SP	ELS 489 (SP477661)	25°16′16″ S, 48°33′04″W
Cololejeunea papilliloba (Steph.) Steph. (Stephani 1890: 73, Stephani 1890: 135)	RA/EN	MG, RS, SP	DFP 17861 (SP461403)	25°30′55″ S, 48°58′58″W
Colura calyptrifolia (Hook. f.) Dumort. (Hooker 1813: 1013, Dumortier 1835: 12)	RA	MG, RJ	DFP 17757 (SP461299)	25°27′10″ S, 48°55′11″W
Cyclolejeunea convexistipa (Lehm. & Lindb.) A. Evans (Lehmann & Lindenberg 1834: 43, Evans 1904: 198)	AM	AL, AM, AP, BA, CE, MA, PA, PE, RJ, RN, RO, SP	DFP 16185 (SP454763)	25°26′11″ S, 48°55′14″W
Cyclolejeunea luteola (Spruce) Grolle (Spruce 1884: 205, Grolle 1984: 761)	MO	AM, BA, MG, MT, PA, PE, RJ, RR, SP	DFP 15800 (SP452222)	25°26′55″ S, 48°54′54″W
Dicranolejeunea axillaris (Nees & Mont.) Schiffn. (Nees von Esenbeck & Montagne 1936: 59, Schiffner in Engler & Prantl 1893: 128)	RA	PR, RJ, SP	DFP 16813 (SP460347)	25°26′15″ S, 48°55′09″W
Diplasiolejeunea brunnea Steph., 1916 (Fig. 43)	MO	AC, AL, AM, BA, CE, ES, MT, PA, RJ, RO, SC, SP	DFP 17699 (SP461240)	25°27′10″ S, 48°55′11″W
Diplasiolejeunea inermis P. Tixier, 1985	RA	RJ, SC	DFP 15771 (SP452193)	25°26′55″ S, 48°54′54″W
Drepanolejeunea anoplantha (Spruce) Steph. (Spruce 1884: 189, Stephani 1913: 325)	MO	AM, BA, CE, ES, PB, RJ, RS, SP	DFP 15972 (SP452394)	25°26′55″ S, 48°54′54″W
Drepanolejeunea araucariae Steph., 1896	MO	MG, RJ, RS, SC, SP	DFP 15881 (SP452303)	25°26′55″ S, 48°54′54″W
Drepanolejeunea campanulata (Spruce) Steph. (Spruce 1884: 192, Stephani 1913: 328)	RA	RJ, SC, SP	DFP 17890 (SP461432)	25°30′55″ S, 48°58′58″W
Drepanolejeunea capulata (Taylor) Steph. (Taylor 1846: 394, Stephani 1913: 328)	MO	AM, SP	DFP 17723 (SP461264)	25°27′10″ S, 48°55′11″W
Drepanolejeunea fragilis Bischl., 1964	AM	AL, AM, AP, BA, CE, ES, MG, PA, PE, RJ, RR, SP	DFP 17745 (SP461286)	25°27′10″ S, 48°55′11″W
Drepanolejeunea mosenii (Steph.) Bischl. (Stephani 1913: 372, Bischer 1967: 118)	MO	AM, BA, ES, MG, PE, PR, RJ, RS, SC, SP	DFP 17752 (SP461294)	25°27′10″ S, 48°55′11″W
Drepanolejeunea orthophylla (Nees & Mont.) Bischl. (Nees von Esenbeck & Montagne 1843: 265, Bischler 1967: 102)	MO	AM, PA, RJ, SC, SP	DFP 17696 (SP461237)	25°27′10″ S, 48°55′11″W
Harpalejeunea oxyphylla (Nees & Mont.) Steph. (Nees von Esenbeck 1843: 262, Stephani 1890: 76)	MO	AM, BA, PA, PB, PE, RJ, RR, SP	DFP 15909 (SP452331)	25°26′55″ S, 48°54′54″W
Harpalejeunea stricta (Lindenb. & Gottsche) Steph. (Lindenberg & Gottsche 1847: 756, Stephani 1913: 259)	MO	AL, BA, MG, PA, PE, RJ, SP	ELS 336 (SP477506)	25°15′57″ S, 48°32′42″W
Harpalejeunea tridens (Besch. & Spruce) Steph. (Bescherelle & Spruce 1890: 36, Stephani 1913: 263)	RA	SP, PE	DFP 17670 (SP461211)	25°27′10″ S, 48°55′11″W
Lejeunea bermudiana (A. Evans) R.M. Schuster (Evans 1906: 132, Schuster 1980: 1105)	MO	AC, ES, PA, RJ, SP	DMC 1143 (SP455291)	25°26′11″ S, 48°55′14″W
Lejeunea caulicalyx (Steph.) M.E. Reiner & Goda (Stephani 1913: 237, Reiner & Goda 2000: 13)	AM	AC, AL, BA, ES, MS, MT, PA, PE, PR, RJ, RR, SP	DFP 17853 (SP461395)	25°30′55″ S, 48°58′58″W
Lejeunea cerina (Lehm. & Lindb.) Gottsche & et al. (Lehmann & Lindenberg in Lehmann 1833: 16, Gottsche et al. 1845: 391)	MO	AC, BA, ES, PE, RJ, SP	DFP 17728 (SP461269)	25°27′10″ S, 48°55′11″W
Lejeunea controversa Gottsche & Rabenh., 1872	MO	AC, AL, BA, MS, PA, PE, RJ, SP	DFP 16251 (SP454829)	25°26′11″ S, 48°55′14″W
Lejeunea cristulata (Steph.) M.E. Reiner & Goda (Stephani 1896: 75, Reiner & Goda 2000: 89)	MO/EN	BA, ES, MG, PE, PR, RJ, RS, SC, SP	DFP 15709 (SP452131)	25°26′55″ S, 48°54′54″W
Lejeunea deplanata Ness, 1845	MO	AC, AL, BA, ES, MS, PA, RJ	DFP 16004 (SP452426)	25°26′11″ S, 48°55′14″W
Lejeunea flava (Sw.) Nees (Swartz 1788: 144, Nees von Esenbeck 1838: 277) (Fig. 44)	AM	AC, AL, AM, BA, CE, DF, ES, GO, MA, MG, MS, MT, PA, PB, PE, PR, RJ, RR, RS, SC, SE, SP, TO	ELS 347 (SP477517)	25°15′57″ S, 48°32′42″W

Table 1. *Continued.*

Taxon	Dist. Brazil	Brazilian states	Voucher	Coordinates
Lejeunea glaucescens Gottsche, 1845	AM	AC, AM, BA, CE, DF, ES, GO, MG, MS, MT, PA, PE, PR, RJ, RR, RS, SC, SP	RR 2867 (SP437142)	25°27′14″ S, 48°55′12″W
Lejeunea grossitexta (Steph.) E. Reiner & Goda (Steph 1913: 240, Reiner & Goda 2000)	MO	AL, BA, CE, ES, MG, PR, RJ, SC, SP	DFP 16119 (SP452545)	25°26′11″ S, 48°55′14″W
Lejeunea laeta (Lehm. & Lindenb.) Lehm. & Lindenb. (Lehmann & Lindenberg 1834: 45, Lehmann & Lindenberg 1845: 380)	MO	BA, CE, MG, PR, RJ, SC, SP	RR s.n. (SP462189)	25°26′20″ S, 48°55′11″W
Lejeunea laetevirens Nees & Mont., 1842	AM	AC, AL, AM, AP, BA, CE, DF, ES, GO, MA, MS, MT, PA, PB, PE, PR, RJ, RN, RR, RS, SC, SE, SP	DFP 17953 (SP462404)	20°45′39″W, 41°32′05″W
Lejeunea oligoclada Spruce, 1889	MO/EN	AL, BA, ES, MG, PE, PR, RJ, SC, SP	DFP 17688 (SP461229)	25°27′10″ S, 48°55′11″W
Lopholejeunea nigricans (Lindb.) Schiffn. (Lindenberg 1845: 316, Stephani 1898: 293)	AM	AC, AL, AM, BA, CE, DF, ES, GO, MA, MG, MS, MT, PA, PE, PR, RJ, RS, SC, SP	DFP 16011 (SP452434)	25°26′11″ S, 48°55′14″W
Marchesinia bongardiana Trevis., 1877	AM	AM, RJ, SC, SP	DFP 16213 (SP454791)	25°26′11″ S, 48°55′14″W
Marchesinia brachiata (Sw.) Schiffn. (Swartz 1788: 144, Schiffner in Engler & Prantl 1893: 128)	AM	BA, CE, ES, MG, MT, PE, PR, RJ, RR, SC, SE, SP	DFP 15929 (SP452351)	25°26′55″ S, 48°54′54″W
Microlejeunea acutifolia Steph., 1896	RA	PA	DMC 1129 (SP455277)	25°26′11″ S, 48°55′14″W
Microlejeunea cystifera Herzog, 1950	RA	BA, SP	DFP 15764 (SP452186)	25°26′55″ S, 48°54′54″W
Microlejeunea epiphylla Bischl., 1963 (Fig. 45)	AM	AL, AP, BA, CE, ES, GO, MA, MG, MS, PA, PB, PE, RJ, SE, SP, TO	DFP 15996 (SP452418)	25°26′11″ S, 48°55′14″W
Lejeuneaceae				
Microlejeunea globosa (Spruce) Steph. (Spruce 1889: 193, Stephani 1915: 821)	MO	ES, PA, PR, RS, SC, SE, SP	DFP 17714 (SP461255)	25°27′10″ S, 48°55′11″W
Myriocoleopsis minutissima (Sm.) R.L. Zhu *et al.* (Smith 1806: 1633, Zhu et al. 2014: 293)	AM	AC, AM, BA, ES, MG, MS, MT, PE, PR, RJ, RR, SC	DFP 16822 (SP460356)	25°26′15″ S, 48°55′09″W
Neurolejeunea breutelii (Gottsche) A. Evans (Gottsche 1845: 324, Evans 1907: 13)	MO	BA, ES, MG, PE, PR, RJ, RS, SC, SP	DFP 17746 (SP461287)	25°27′10″ S, 48°55′11″W
Odontolejeunea lunulata (F. Weber) Schiffn. (Weber 1815: 33, Schiffner in Engler & Prantl 1893: 128)	AM	AC, AM, AP, BA, CE, ES, MG, MT, PA, PE, PR, RJ, RR, RS, SP	DFP 16021 (SP452444)	25°26′11″ S, 48°55′14″W
Omphalanthus filiformis (Sw.) Nees (Swartz 1788: 144, Nees 1845: 304)	AM	AM, BA, CE, ES, MG, PE, RJ, RS, SE, SP	ELS 337 (SP477507)	25°15′57″ S, 48°32′42″W
Physantholejeunea huctumalcensis (Lindenb. & Gottsche) Heinrichs & Schäf.-Verw. (Lindenberg & Gottsche 1847: 762, Heinrichs et al. 2013: 387)	RA	AM, BA, PA	DFP 16007 (SP452429)	25°26′11″ S, 48°55′14″W
Prionolejeunea aemula (Gottsche) A. Evans (Gottsche 1845: 338, Evans 1904: 219)	MO	AM, BA, MT, PA, PE, RJ, RR, SE, SP	ELS 339 (SP477509)	25°15′57″ S, 48°32′42″W
Prionolejeunea scaberula (Spruce) Steph. (Spruce 1884: 159, Stephani 1913: 214)	RA/EN	AM, BA, MA, SP	DFP 16024 (SP452447)	25°26′11″ S, 48°55′14″W
Taxilejeunea isocalycina (Nees) Steph. (Nees von Esenbeck in Martius 1833: 356, Stephani 1903: 118)	MO	AM, ES, MG, PA, PR, RJ, SC, SP	DFP 17880 (SP461422)	25°30′55″ S, 48°58′58″W
Taxilejeunea pterigonia (Lehm. & Lindb.) Schiffn. (Lehmann & Lindenberg 1834: 44, Schiffner in Engler & Prantl 1893: 125) (Fig. 46)	MO	ES, MG, RJ, RS, SC, SP	DFP 17691 (SP461232)	25°27′10″ S, 48°55′11″W
Xylolejeunea crenata (Nees & Mont.) X.-L. He & Grolle (Montagne 1838: 48, He & Grolle 2001: 36)	AM	AL, AM, AP, BA, ES, MA, MG, PA, PE, RJ, RO, RR, SC, SP	DFP 16086 (SP452512)	25°26′11″ S, 48°55′14″W
Lepicoleaceae				
Lepicolea ochroleuca (Spreng.) Spruce (Sprengel 1827: 325, Spruce 1885: 345)	RA	RS, SC	DFP 16747 (SP460281)	25°27′00″ S, 48°55′05″W
Lepidoziaceae				
Bazzania arcuata (Lindb. & Gottsche) Trevis. (Lindenberg & Gottsche 1863, Trevisan 1877: 414)	AM	AM, MG, RJ, SP	ELS 323 (SP477493)	25°15′57″ S, 48°32′42″W
Bazzania aurescens Spruce, 1885	MO	AM, BA, ES, GO, MG, PR, RJ, SC, SP	ELS 451 (SP477622)	25°15′57″ S, 48°32′42″W
Bazzania cuneistipula (Gottsche et al.) Trevis. (Gottsche et al. 1845: 225, Trevisan 1877: 414)	RA	MG, RJ, SP	DFP 17907 (SP461449)	25°30′55″ S, 48°58′58″W
Bazzania gracilis (Hampe & Gottsche) Stephani (Hampe & Gottsche 1852: 346, Stephani 1888: 279)	MO	AM, BA, ES, MG, PE, RJ, RR, SP	DFP 17653 (SP461194)	25°27′10″ S, 48°55′11″W
Bazzania heterostipa (Steph.) Fulford (Stephani 1909: 532, Fulford 1959: 410)	MO/EN	BA, ES, MG, PE, PR, RJ, RS, SC, SP	DFP 15726 (SP452148)	25°26′55″ S, 48°54′54″W
Lepidoziaceae				
Bazzania hookeri (Lindb.) Trevis. (Lindenberg 1845: 166, Trevisan 1877: 414) (Fig. 47)	AM	AM, BA, ES, MG, PR, RJ, RR, RS, SC, SP	ELS 325 (SP477495)	25°15′57″ S, 48°32′42″W
Bazzania jamaicensis (Lehm. & Lindb.) Trevis. (Lehmann & Lindenberg 1838: 7, Trevisan 1877: 414)	MO	MG, PR, RJ, SC, SP	DFP 17713 (SP461254)	25°27′10″ S, 48°55′11″W
Bazzania pallide-virens (Steph.) Fulford (Stephani 1908: 473, Fulford 1946: 42)	MO	AM, CE, GO, MT, RJ, RR	RR s.n. (SP462181)	25°26′49″ S, 48°54′53″W
Bazzania taleana (Gottsche) Fulford (Gottsche 1863: 131, Fulford 1946: 54)	RA	ES, RJ, SC, SP	ELS 551 (SP477723)	25°18′20″ S, 48°35′09″W
Kurzia capillaris (Sw.) Grolle (Swartz 1788: 144, Grolle 1963: 173)	AM	AM, BA, CE, DF, ES, GO, MG, MT, PA, PR, RJ, SC, SP	ELS 322 (SP477492)	25°15′57″ S, 48°32′42″W
Lepidozia coilophylla Taylor, 1846	RA	MG, RJ, SC, SP	DFP 16147 (SP452573)	25°26′11″ S, 48°55′14″W
Lepidozia cupressina (Sw.) Lindb. (Swartz 1788: 144, Lindenberg 1845: 207)	RA	BA, PE, RJ, SP	DFP 17843 (SP461385)	25°30′55″ S, 48°58′58″W

Table 1. *Continued.*

Taxon	Dist. Brazil	Brazilian states	Voucher	Coordinates
Lepidozia inaequalis Lehm. & Lindb., 1845 (Fig. 48)	MO	BA, MG, PR, RJ, SC, SP	DFP 15942 (SP452364)	25°26′55″ S, 48°54′54″ W
Paracromastigum pachyrhizum (Nees) Fulford (Nees von Esenbeck in Martius 1833: 339, Fulford 1968: 390)	MO	DF, ES, GO, MG, RJ, SC, SP	ELS 384 (SP477554)	25°15′57″ S, 48°32′42″ W
Telaranea diacantha (Mont.) J.J. Engel & G.L. Merrill (Montagne 1845: 349, Engel & Merril 2004: 145)	AM	AC, AM, BA, DF, ES, GO, PA, PE, PR, RJ, RS, SP	DFP 16263 (SP454842)	25°26′11″ S, 48°55′14″ W
Telaranea nematodes (Austin) M. Howe (Austin 1879: 302, Howe 1902: 284)	AM	AC, AM, BA, CE, DF, ES, GO, MG, MS, MT, RJ, RR, RS, SC, SE, SP	DFP 15944 (SP452366)	25°26′55″ S, 48°54′54″ W
Marchantiaceae				
Dumortiera hirsuta (Sw.) Nees (Swartz 1788: 145, Nees von Esenbech in Martius 1833: 307)	AM	AC, AM, DF, ES, GO, MG, MS, MT, PA, PE, PR, RJ, RS, SC, SP	DFP 16013 (SP452436)	25°26′11″ S, 48°55′14″ W
Marchantia chenopoda L., 1753	AM	AM, DF, ES, GO, MG, MS, MT, PR, RJ, RS, SC, SP	DFP 16168 (SP452594)	25°26′11″ S, 48°55′14″ W
Marchantia papillata Raddi, 1822	MO	MG, MS, MT, PR, RJ, RS, SC, SP	DFP 16002 (SP452424)	25°26′11″ S, 48°55′14″ W
Metzgeriaceae				
Metzgeria albinea Spruce, 1889 (Fig. 49)	AM	BA, CE, ES, GO, MG, PE, PR, RJ, RS, SC, SP	DFP 16227 (SP454805)	25°26′11″ S, 48°55′14″ W
Metzgeria bahiensis Schiffn., 1911	RA/EN	BA, RS, SP	DFP 15770 (SP452192)	25°26′55″ S, 48°54′54″ W
Metzgeria brasiliensis Schiffn., 1964	MO/EN	AL, BA, PR, RJ, RS, SC, SP	DFP 16765 (SP460299)	25°27′00″ S, 48°55′05″ W
Metzgeria conjugata Lindb., 1875	MO	ES, MG, PR, RJ, RS, SP	DFP 15767 (SP452189)	25°26′55″ S, 48°54′54″ W
Metzgeria consanguinea Schiffn., 1893	RA	PR, RJ, SP	RR 4254 (SP458471)	25°26′57″ S, 48°55′53″ W
Metzgeria fruticola Spruce, 1885	RA	AL, RJ, RS	RR s.n. (SP462177)	25°26′49″ S, 48°54′53″ W
Metzgeria hegewaldii Kuwah., 1981	RA	RS	DFP 17862 (SP461404)	25°30′55″ S, 48°58′58″ W
Metzgeria myriopoda Lindb., 1877	MO	DF, ES, GO, MG, PE, RJ, RS, SC, SP	DFP 15886 (SP452308)	25°26′55″ S, 48°54′54″ W
Metzgeria uncigera A. Evans, 1910	MO	ES, MG, PE, PR, RJ, RS, SC, SP	DFP 17917 (SP461459)	25°30′55″ S, 48°58′58″ W
Pallaviciniaceae				
Symphyogyna aspera Steph., 1914	AM	AM, BA, CE, DF, ES, GO, MG, MS, MT, PA, PE, PR, RJ, RS, SC, SE, SP	DFP 16085 (SP452511)	25°26′11″ S, 48°55′14″ W
Symphyogyna brasiliensis Nees, 1836 (Fig. 50)	AM	BA, CE, DF, ES, GO, MG, MT, PR, RJ, RO, RR, RS, SC, SP	DFP 15741 (SP452163)	25°26′55″ S, 48°54′54″ W
Symphyogyna brongniartii Mont., 1843	MO	AC, AM, MG, MS, RJ, RS, SC, SP	DFP 16808 (SP460341)	25°26′15″ S, 48°55′09″ W
Symphyogyna podophylla (Thunb.) Mont. & Nees (Thunberg 1800: 174, Montagne & Nees von Esenbeck 1846: 481)	MO	BA, CE, ES, MG, PR, RJ, SP	ELS 535 (SP477707)	25°18′20″ S, 48°35′09″ W
Pelliaceae				
Noteroclada confluens (Hook. f. & Taylor) Spruce (Hooker & Taylor 1844: 478, Spruce 1885: 531)	MO	DF, ES, GO, MG, PR, RJ, RS, SC, SP	DFP 16810 (SP460343)	25°26′15″ S, 48°55′09″ W
Plagiochilaceae				
Plagiochila adianthoides (Sw.) Lindenb. (Swartz 1788: 142, Lindenberg 1840: 77) (Fig. 51)	MO	BA, ES, GO, MG, RJ, SP	DFP 15736 (SP452158)	25°26′55″ S, 48°54′54″ W
Plagiochila aerea Taylor, 1846	RA	BA, PE, RJ	DFP 17738 (SP461279)	25°27′10″ S, 48°55′11″ W
Plagiochila bifaria (Sw.) Lindb. (Swartz 1788: 145, Lindenberg 1843: 127)	MO	AM, BA, ES, MG, PA, RJ, SP	ELS 249 (SP459057)	25°30′49″ S, 48°59′20″ W
Plagiochila corrugata (Nees) Nees & Mont. (Nees von Esenbeck in Martius1833: 378, Nees von Esenbeck & Montagne 1836: 52)	AM	AC, BA, CE, DF, ES, GO, MG, PE, PR, RJ, RS, SC, SE, SP	ELS 313 (SP477483)	25°15′57″ S, 48°32′42″ W
Plagiochila cristata (Sw.) Lindb. (Swartz 1788: 143, Lindenberg 1839: 33)	MO	AM, BA, ES, MG, PA, PR, RJ, RN, SP	ELS 447 (SP477618)	25°15′57″ S, 48°32′42″ W
Plagiochila exigua (Taylor) Taylor (Taylor 1843: 179, Taylor 1846: 264-265)	RA	BA, MG, RJ, SP	DFP 17668 (SP461209)	25°27′10″ S, 48°55′11″ W
Plagiochila gymnocalycina (Lehm. & Lindenb.) Mont. (Lehmann & Lindenberg in Lehmann 1833: 28, Montagne 1839: 2581)	MO	AL, BA, ES, MG, PE, RJ, SC, SP	ELS 312 (SP477482)	25°15′57″ S, 48°32′42″ W
Plagiochila macrostachya Lindb., 1840	MO	ES, MG, PA, PR, RJ, SC, SP	DFP 15960 (SP452382)	25°26′55″ S, 48°54′54″ W
Plagiochila martiana (Nees) Lindb. (Nees von Esenbeck 1831: 617, Lindenberg 1839: 12)	AM	AC, AL, BA, CE, DF, ES, GO, MG, MS, MT, PA, PE, PR, RJ, RS, SC, SP	ELS 259 (SP459067)	25°30′49″ S, 48°59′20″ W
Plagiochila patentissima Lindb., 1841	AM	BA, CE, ES, MG, PB, PE, PR, RJ, RS, SC, SP	DFP 16056 (SP452480)	25°26′11″ S, 48°55′14″ W
Plagiochila patula (Sw.) Lindb. (Swartz 1806: 1844, Lindenberg 1839: 21)	MO	AC, BA, MG, PA, PE, PR, RJ, SP	ELS 355 (SP477525)	25°15′57″ S, 48°32′42″ W
Plagiochila rutilans Lindb., 1840	AM	AC, AM, AP, BA, CE, ES, MG, MT, PA, PE, PR, RJ, RR, RS, SC, SP	ELS 359 (SP477529)	25°15′57″ S, 48°32′42″ W
Plagiochila simplex (Sw.) Lindb. (Swartz 1788: 145, Lindenberg 1840: 54)	AM	AM, BA, ES, MG, MT, PA, PE, PR, RJ, RS, SC, SP	ELS 525 (SP477697)	25°18′20″ S, 48°35′09″ W
Plagiochila subplana Lindb., 1840	AM	AM, AP, BA, ES, MG, MS, PA, PE, RJ, RR, SC, SP	DFP 15792 (SP452214)	25°26′55″ S, 48°54′54″ W
Radulaceae				
Radula angulata Steph., 1884	MO	ES, GO, MG, PE, PR, RJ, SC, SP	DFP 15834 (SP452256)	25°26′55″ S, 48°54′54″ W
Radula brasilica Yamada, 1993	RA/EN	SP	DFP 15765 (SP452187)	25°26′55″ S, 48°54′54″ W

Table 1. *Continued.*

Taxon	Dist. Brazil	Brazilian states	Voucher	Coordinates
Radula elliottii Castle, 1959	RA	SP	DFP 15817 (SP452239)	25°26′55″ S, 48°54′54″ W
Radula gottscheana Taylor, 1846	RA	AM, RJ	DFP 15731 (SP452153)	25°26′55″ S, 48°54′54″ W
Radula javanica Gottsche, 1845	AM	AC, AM, AP, BA, ES, MG, MS, MT, PA, PE, PR, RJ, RS, SC, SP	DFP 16809 (SP460342)	25°26′15″ S, 48°55′09″ W
Radula mammosa Spruce, 1890	RA	AM, RJ, SP	DFP 15870 (SP452292)	25°26′55″ S, 48°54′54″ W
Radula mexicana Lindb. & Gottsche, 1863	MO	BA, ES, PA, PE, RJ, RS, SP	ELS 376 (SP477546)	25°15′57″ S, 48°32′42″ W
Radula nudicaulis Steph., 1910	MO	ES, MG, PR, RJ, RS, SP	DFP 16018 (SP452441)	25°26′11″ S, 48°55′14″ W
Radula recubans Taylor, 1846 (Fig. 52)	AM	AL, BA, ES, MG, PA, PB, PE, PR, RJ, RS, SC, SP	ELS 262 (SP459070)	25°30′49″ S, 48°59′20″ W
Radula schaefer-verwimpii Yamada, 1990	RA	ES, MG, RJ, SP	DFP 17704 (SP461245)	25°27′10″ S, 48°55′11″ W
Radula tenera Mitt. ex Steph., 1884	RA	PE, PR, RJ, SP	DFP 17683 (SP461224)	25°27′10″ S, 48°55′11″ W
Scapaniaceae				
Scapania portoricensis Hampe & Gottsche, 1852	MO	ES, MG, PR, RJ, RR, SC, SP	ELS 490 (SP477662)	25°16′16″ S, 48°33′04″ W
Trichocoleaceae				
Trichocolea argentea Herzog, 1824	RA/EN	PR, RJ, SC, SP	RR 2804 (SP437095)	25°27′14″ S, 48°55′12″ W
Trichocolea brevifissa Steph., 1909	MO	ES, MG, PR, RJ, RS, SC, SP	ELS 553 (SP477725)	25°18′20″ S, 48°35′09″ W
Trichocolea flaccida (Spruce) Spruce (Spruce 1885: 349, Spruce 1888: 34)	RA	BA, PR, RJ, SP	ELS 261 (SP459069)	25°30′49″ S, 48°59′20″ W
Trichocolea tomentosa (Sw.) Gottsche (Swartz 1788: 145, Gottsche 1863: 119)	MO	ES, MG, PE, PR, RJ, RS, SC, SP	DFP 16757 (SP460291)	25°27′00″ S, 48°55′05″ W

Discussion

Bryophyte species richness. The bryophytes found in our study of PMSP correspond to 40% of all the species recorded from the state of Paraná, although we found fewer species than indicated for this elevational range by Santos and Costa (2010). However, we found 41 Brazilian endemic species, including mosses and liverworts, which is near twice the total of endemic species (21) reported by Santos and Costa (2010). A possible explanation for this difference in species richness and endemism at PMSP is the high incidence of mist, as also observed by Montfoort and Ek (1990) in lowland tropical forests.

Moss species richness at PMSP was greater than that of liverworts, which is in accordance with findings by Santos (2011) in Rio de Janeiro, where liverworts had a greater species richness at lower elevations (between 50 m and 950 m) and mosses had a greater species richness at higher elevations (above 950 m). This pattern is well described in literature, and Gradstein et al. (2001) related the morphology of mosses to the colonization of open sites, like rock cliffs and exposed soils.

Some genera are better represented on our species list than others, and some are well represented by Brazilian endemics. Such genera include *Campylopus* with 16 species (2 endemic), *Fissidens* with 13 species (2 endemic), *Sphagnum* with 13 species (6 endemic), *Plagiochila* with 15 species, *Lejeunea* with 15 species (7 endemic), *Radula* with 12 species (1 endemic), *Frullania* with 10 species, and *Bazzania* with 9 species (1 endemic).

In the PMSP, the family Sphagnaceae had the greatest richness of endemic moss species found. The genus Sphagnum was found to be dominant in the cloud forests that we surveyed, and this dominance was earlier noted by IAP (2006). Sphagnaceae was among the families with the greatest contribution to the high species richness in High Mountain Forest habitats and elevational meadows of Itatiaia National Park, state of Rio de Janeiro (Costa et al. 2015). Species of the genus *Sphagnum* were found growing in dry habitats, such as on such rocks and tree trunks, as well as moist habitats, such as springs and bogs.

With 66 species, the family Lejeuneaceae represented 18% of our list. Citing 83 species from sea level to 1200 m above sea level, this family was identified by Santos (2011) as the most representative of the Atlantic Forest; Sonnleitner et al. (2001) recorded 59 species in a cloud forest in Monte Verde, Costa Rica but at a lower altitude, below 285 m. Lejeuneaceae is the richest family of the recent lineage of Porellales, with about 1000 species (Bechteler et al. 2016) and includes specialists at colonizing bark, branches, twigs, and leaves of trees. Thus, this family is frequently abundant in humid tropical forests (Lücking 1995, Pócs 1996, Gradstein 1997, Cornelissen and Ter Steege 1989, Sonnleitner et al. 2009).

The family Leucobryaceae was represented by 19 species (2 Brazilian endemics) in our study, and Costa et al. (2015) also observed this in Rio de Janeiro state.

Table 2. Bryophyte species number comparison among the Pico do Marumbi State Park with different geographic regions.

Area	Mosses	Liverworts	Reference
Marumbi	189	176	Present research
Paraná	591	309	Yano (2013); Yano (2014); Ristow et al. (2015)
Atlantic Forest	756	464	Costa (2009)
Brazil	880	633	Costa & Peralta (2015)
Tropical America	2600	1350	Gradstein et al. (2001)
World	13000	5000	Gradstein et al. (2001)

Among the Brazilian endemics found in PMSP, *Campylopus occultus* Mitt. (Frahm 1991), has its type locality in the state of Paraná. (Table 1).

Conservation. Our findings reinforce the importance of PMSP for the preservation of the bryophyte flora of Paraná and the recognition of diversity hot spots for prioritizing conservation efforts in areas with high species diversity and endemism (Kier et al. 2009, Costa et al. 2015). Furthermore, our findings expand the known distributions of several Brazilian endemic bryophytes. The bryophyte flora of PMSP has great importance to the conservation of these species with narrow to moderate distributions in Brazil. Of the species that we list, 95 are rare (50 liverworts and 45 mosses), 151 moderate (75 liverworts, 74 mosses, and 2 hornworts), and 118 widespread (60 mosses and 50 liverworts) (Table 1).

According to Costa and Peralta (2015), Brazil has 298 endemic species of bryophytes, with 73 species occurring in Paraná (24% of the total). In PMSP, 41 endemic species were found (25 mosses and 16 liverworts; see Results). Table 2 compares bryophytes richness in various regions of the world, and shows the significance of the PMSP for bryoflora.

Our study, based on new surveys, is a pioneering contribution to the knowledge of the bryoflora of the state of Paraná and Brazil.

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Authors' Contributions

ELS collected the data, wrote the text, and made the analysis; DMC and DFP also collected the data and made the analysis.

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